

FIG. 1A

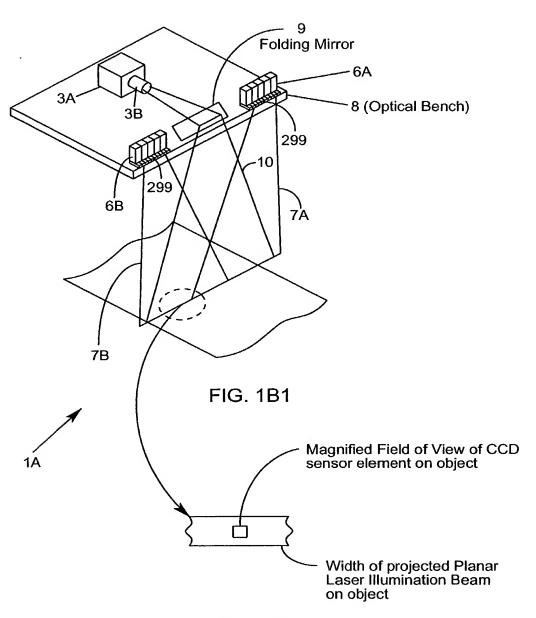


FIG. 1B3

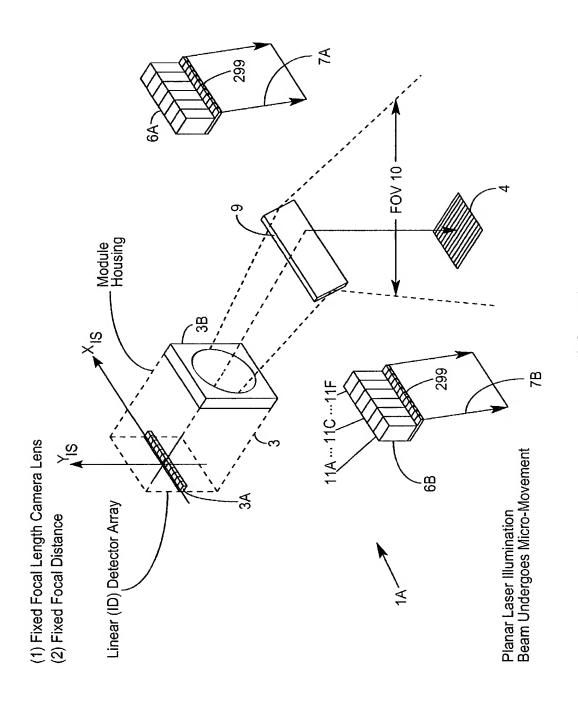


FIG. 1B2

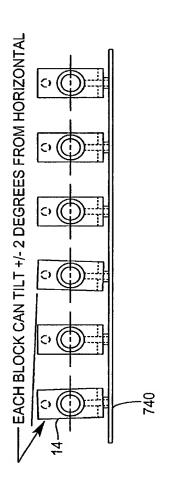
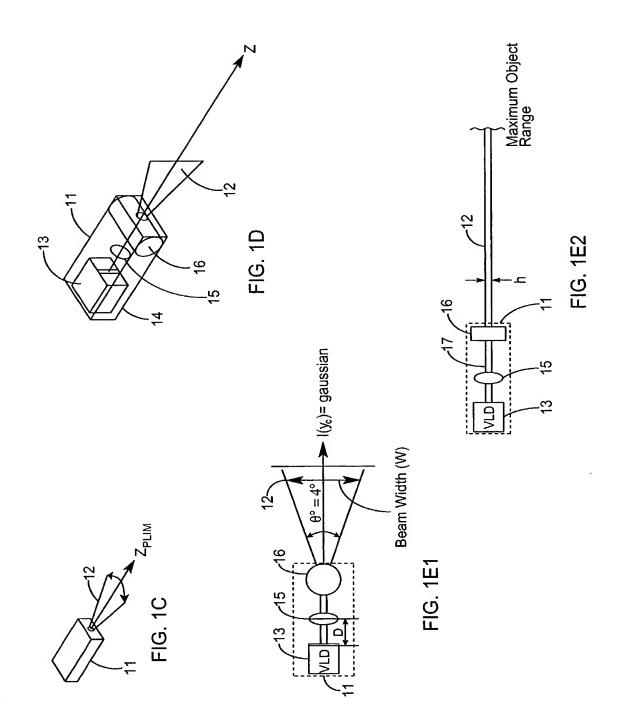


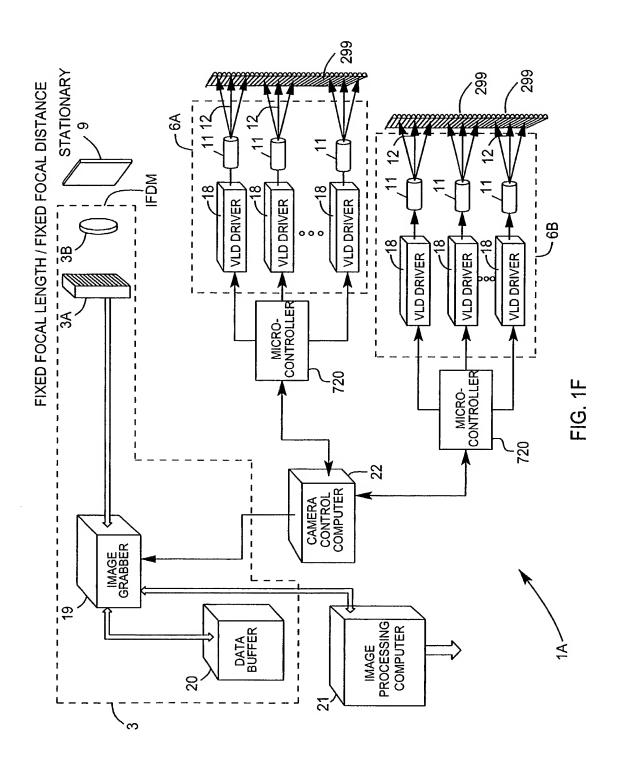
FIG. 1B4

4 5

VLD BLOCK CAN PITCH FORWARD FOR ALIGNMENT WITH OTHER VLD BEAMS

FIG. 1B5





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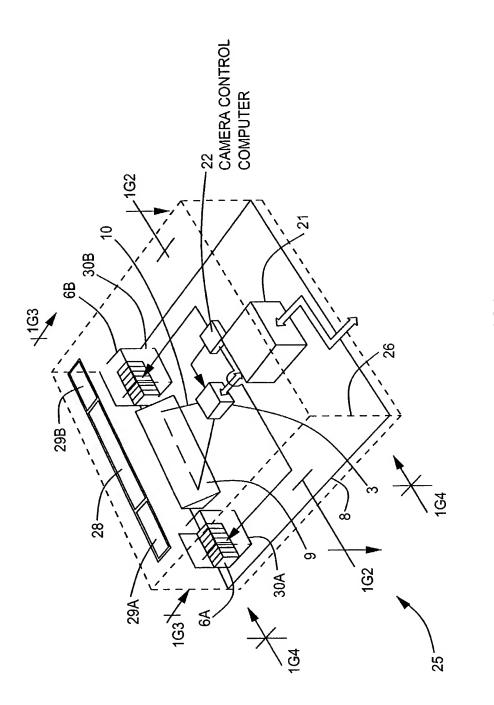


FIG. 1G1

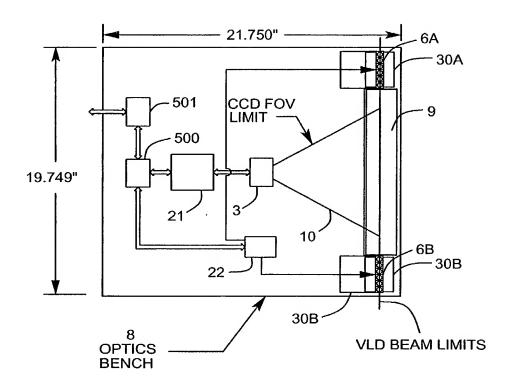


FIG. 1G2

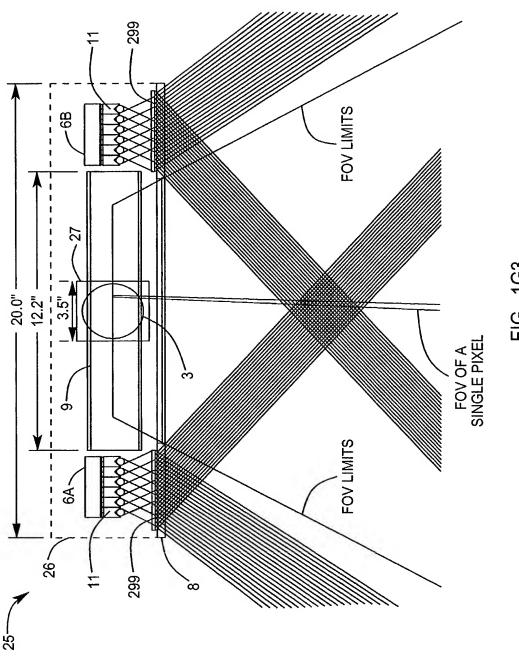


FIG. 1G3

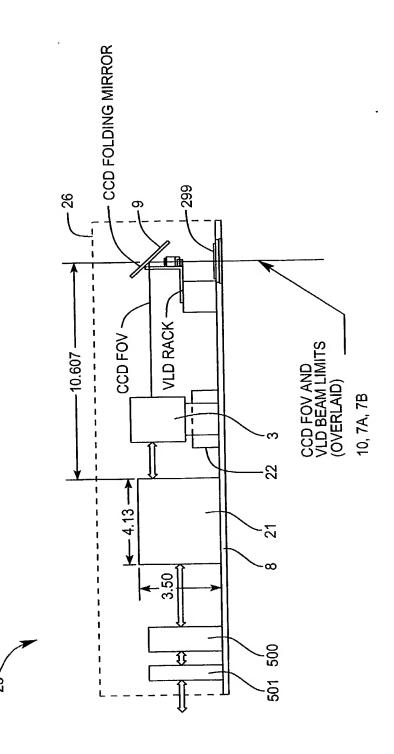


FIG. 1G4

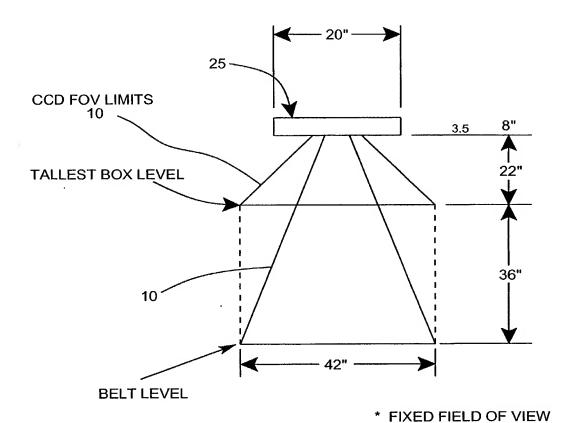


FIG. 1G5

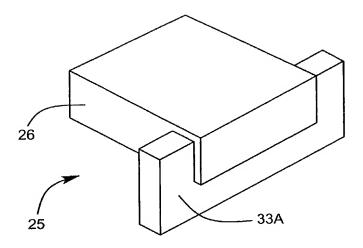


FIG. 1G6

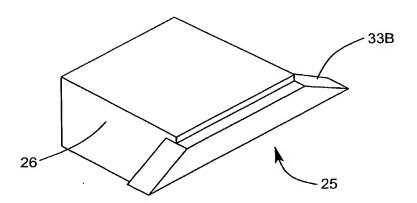
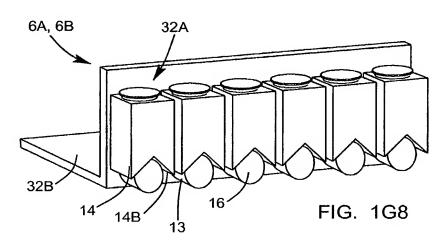
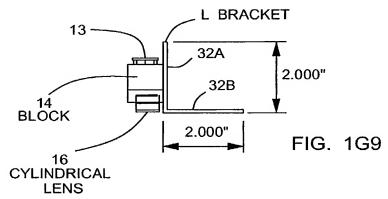


FIG. 1G7





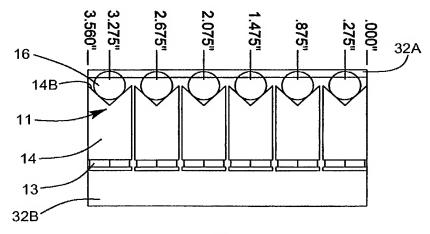


FIG. 1G10

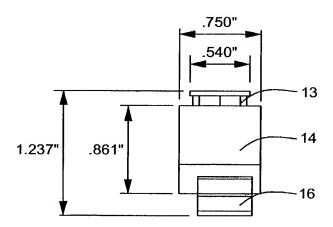


FIG. 1G11

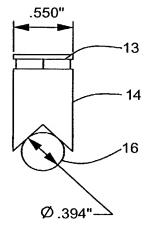


FIG. 1G12

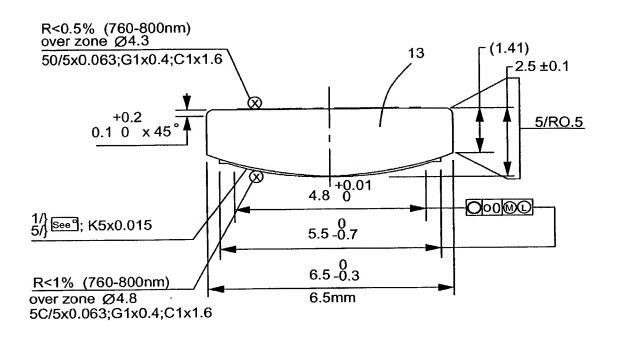


FIG. 1G13

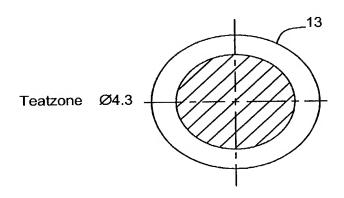


FIG. 1G14

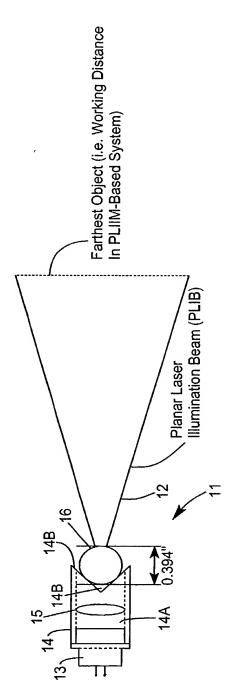


FIG. 1G15A

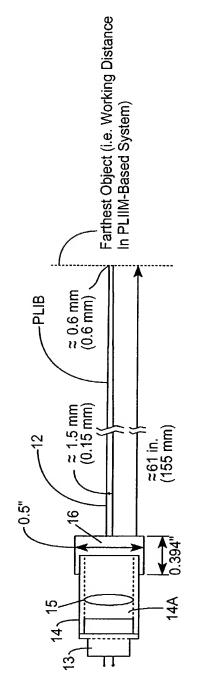


FIG. 1G15B

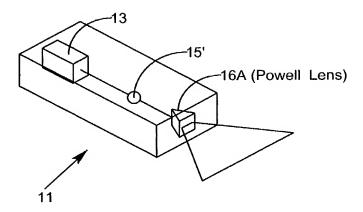


FIG. 1G16A

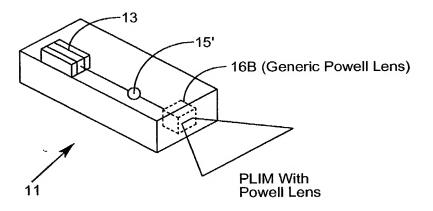


FIG. 1G16B

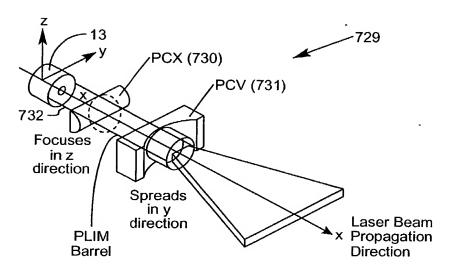
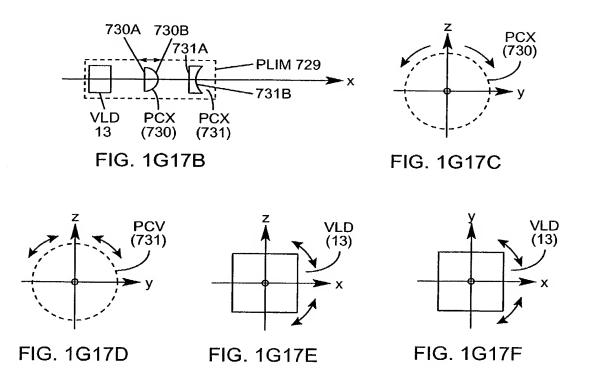


FIG. 1G17A



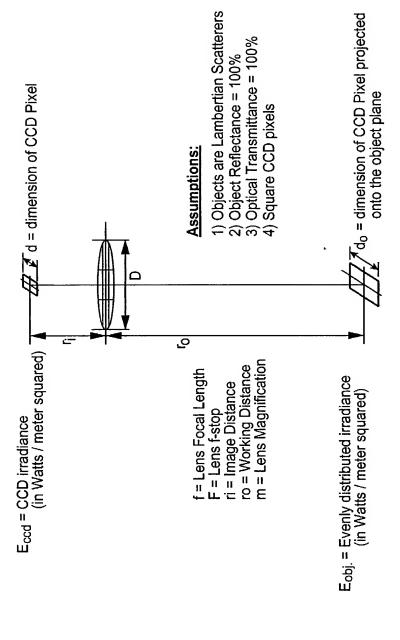


FIG. 1H6

CCD-Based Scanner

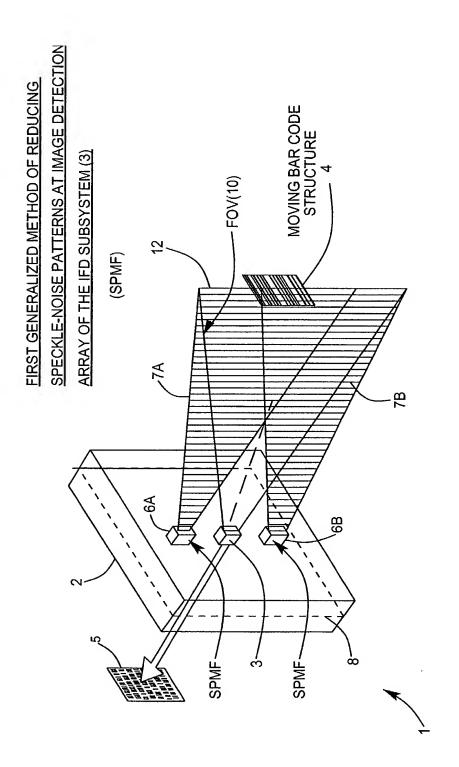


FIG. 111

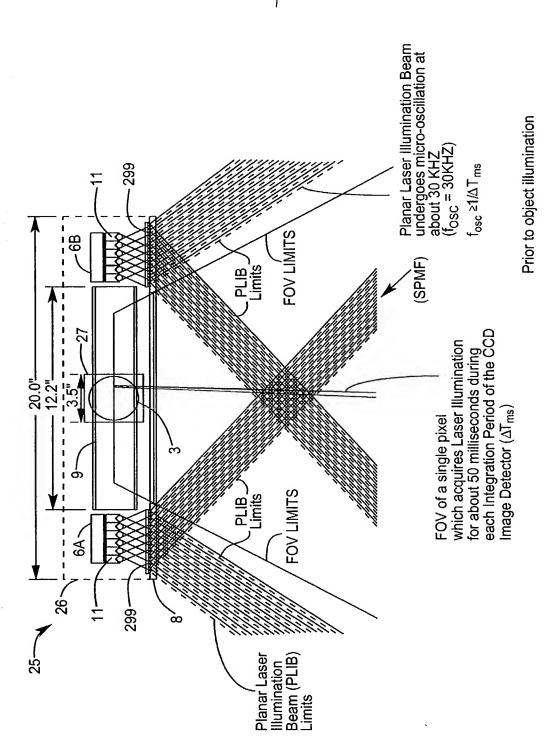


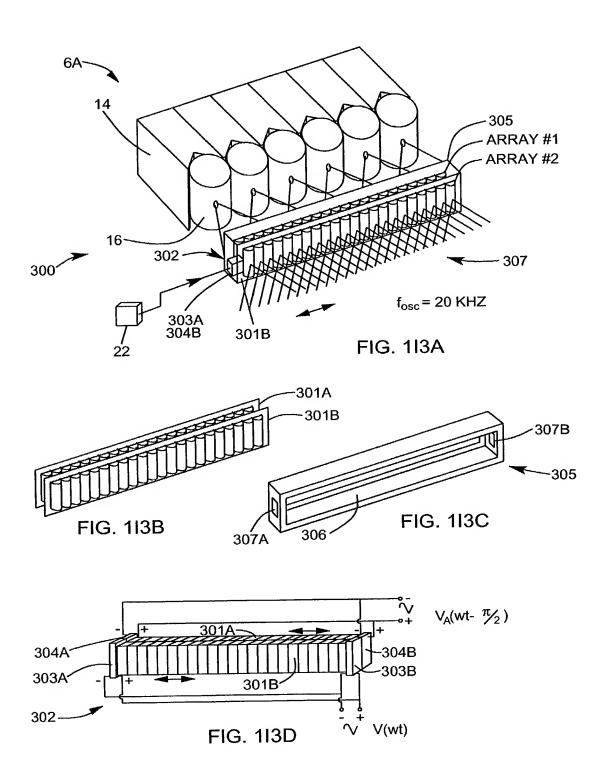
FIG. 112A

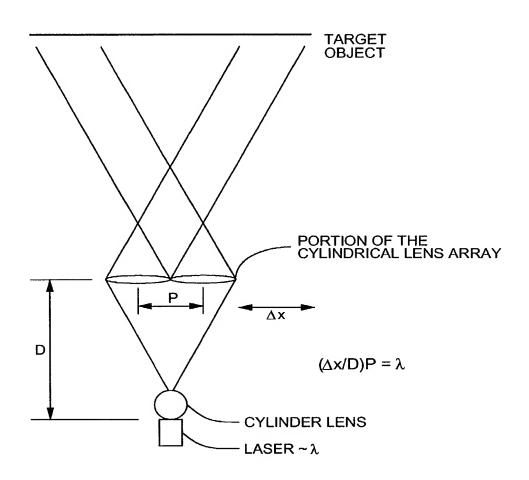
## THE FIRST GENERALIZED SPECKLE-NOISE PATTERN REDUCTION METHOD OF THE PRESENT INVENTION

Prior to illumination of the target with the planar laser illumination beam (PLIB), modulate the spatial phase of the transmitted PLIB along the planar extent thereof according to a spatial phase modulation function (SPMF) so as to produce numerous substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.

Temporally average the numerous substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photointegration time period thereof, so as to thereby reduce the power of the speckle-noise pattern observed at the image detection array.

FIG. 112B





$$\Delta x \ge \frac{\lambda}{P} \cdot D$$

FIG. 113E

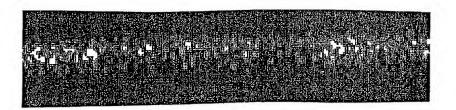
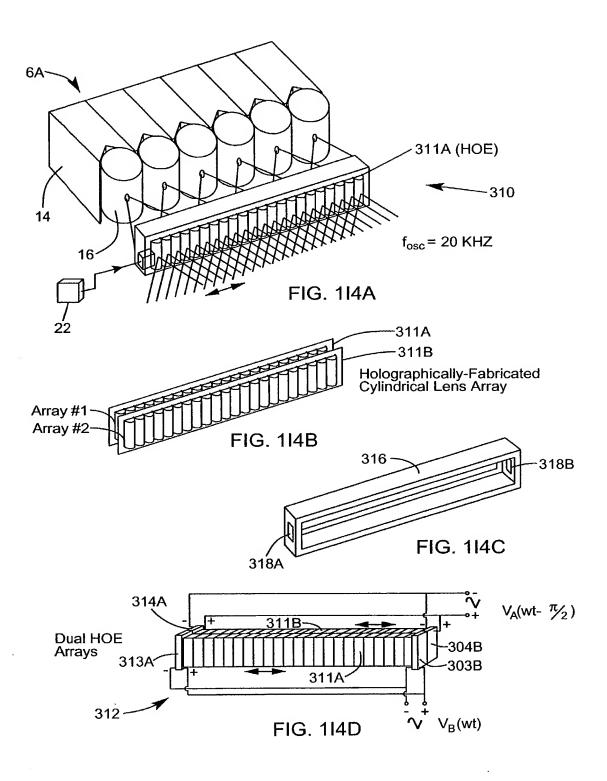
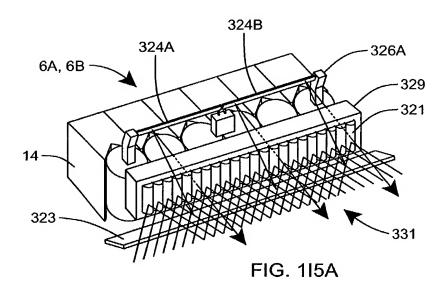


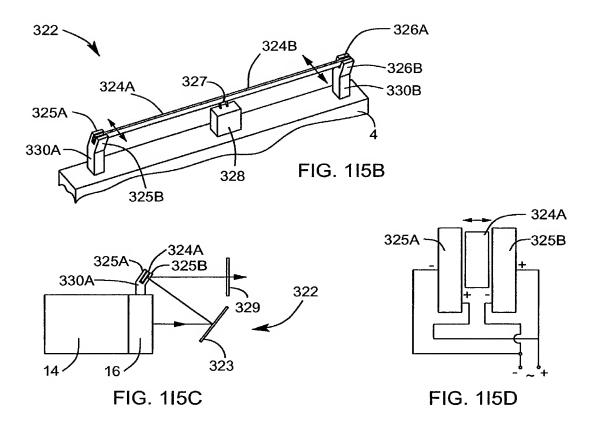
FIG. 113F

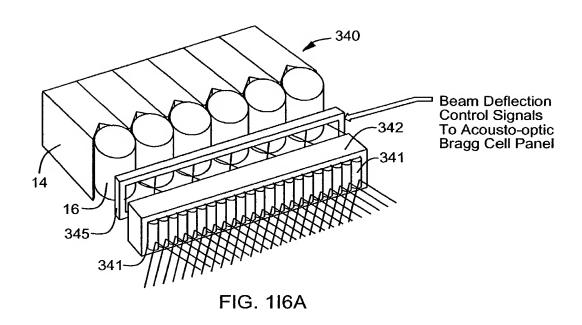


FIG. 113G









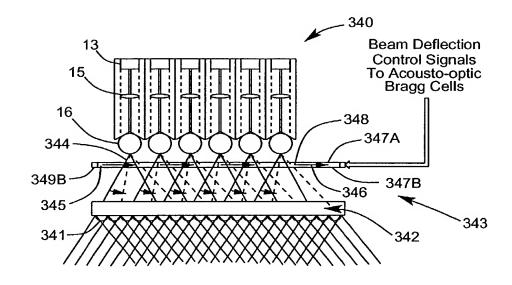
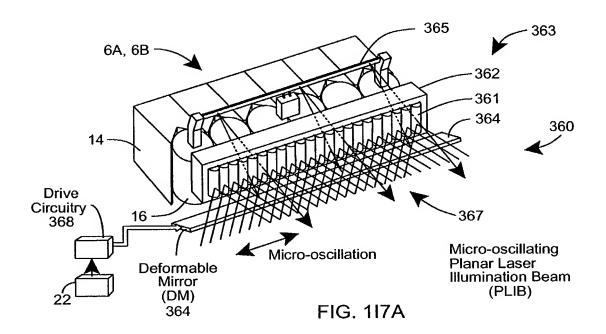
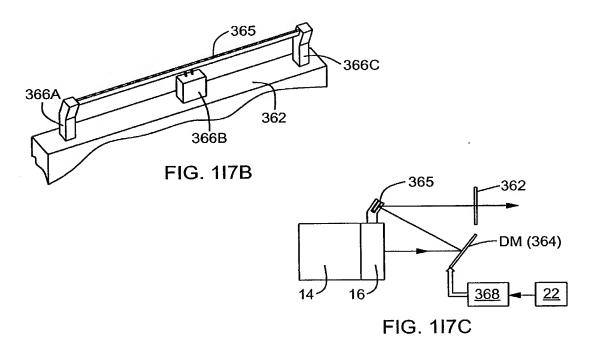
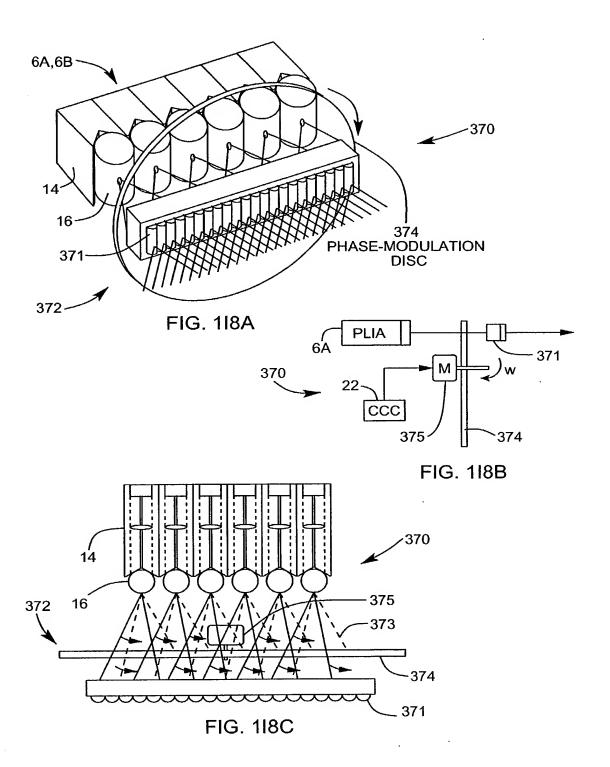


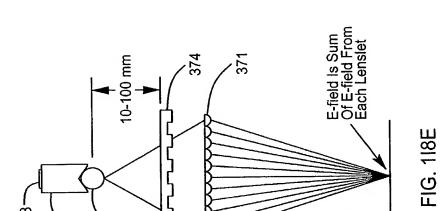
FIG. 116B



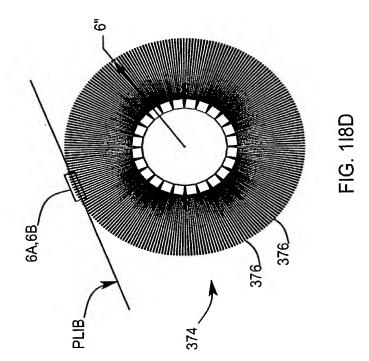


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Target Object

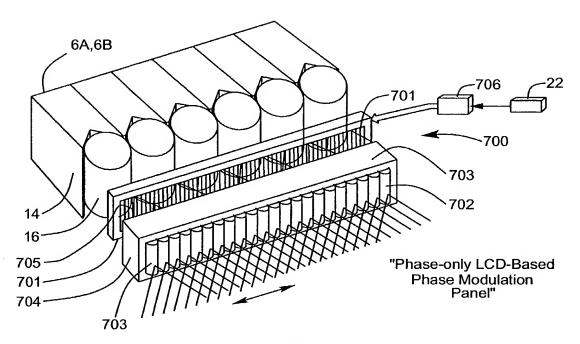


FIG. 118F

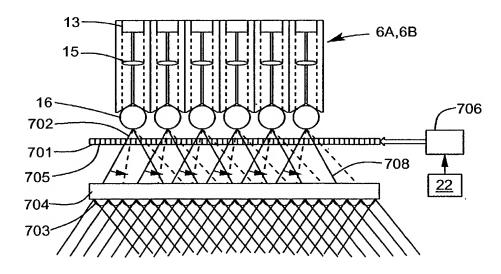


FIG. 118G

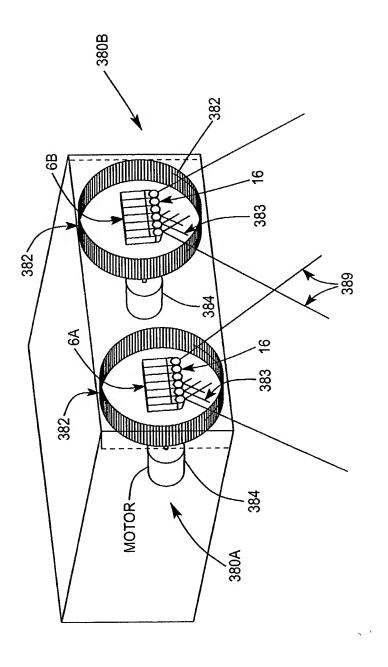


FIG. 119A

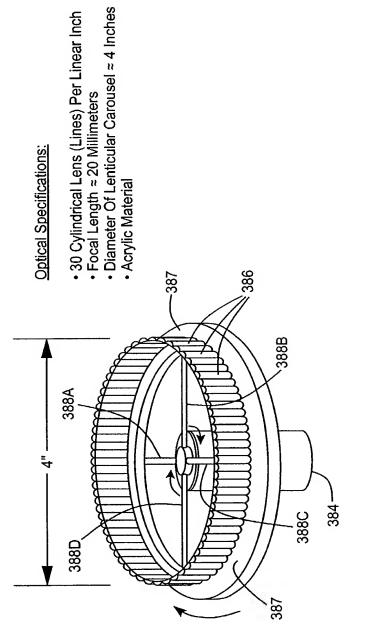


FIG. 119B

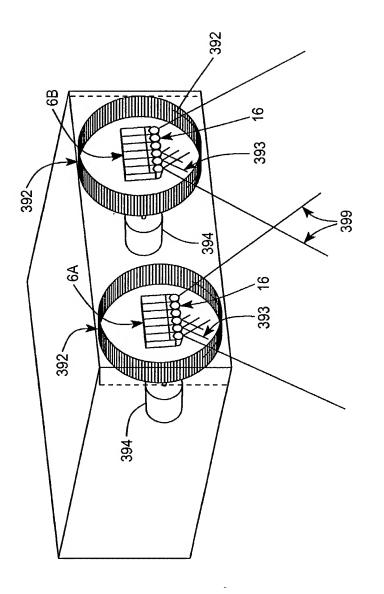
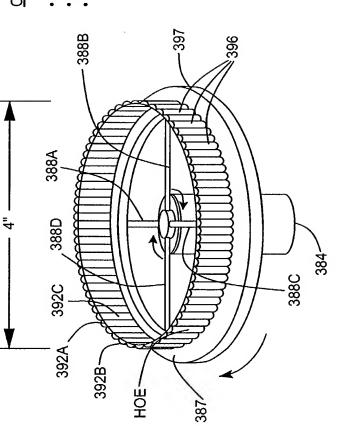


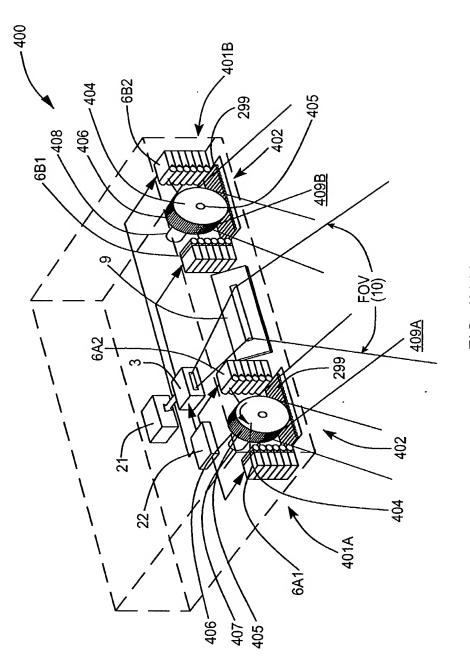
FIG. 1110A



## Optical Specifications:

- 30 Cylindrical Lens (Lines) Per Linear Inch Focal Length  $\approx$  20 Millimeters Diameter Of Lenticular Carousel  $\approx$  4 Inches

FIG. 1110B



IG. 1111A

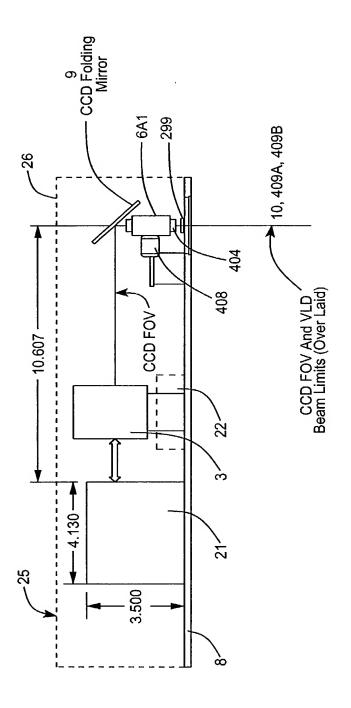


FIG. 1111B

. .:

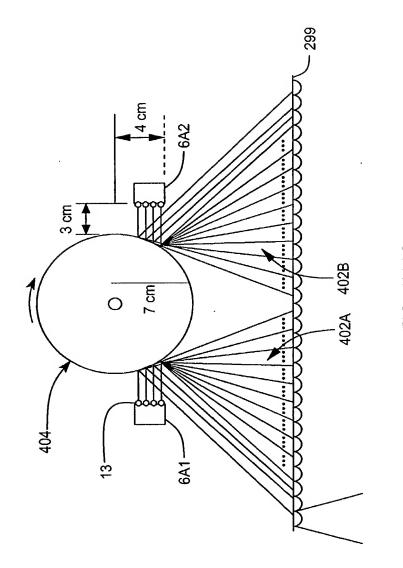


FIG. 1111C

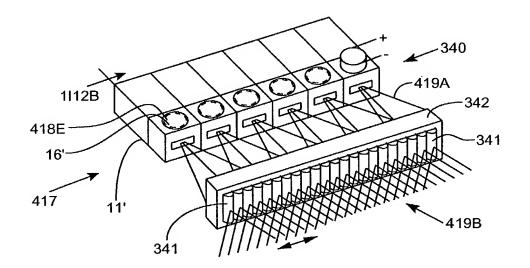


FIG. 1112A

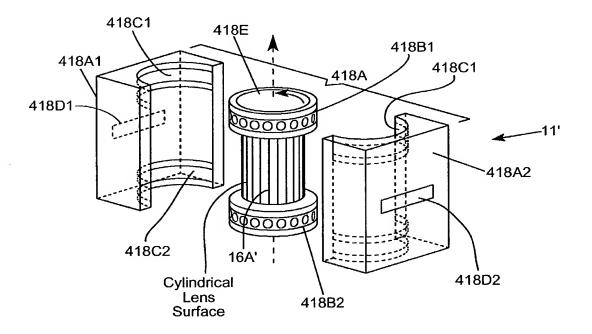


FIG. 1112B

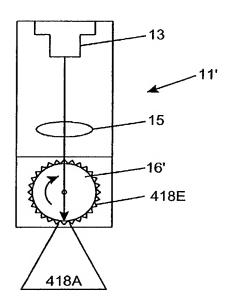


FIG. 1|12C

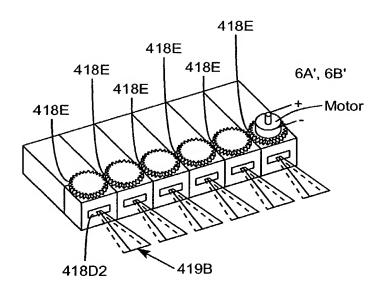


FIG. 1112D

. . . .

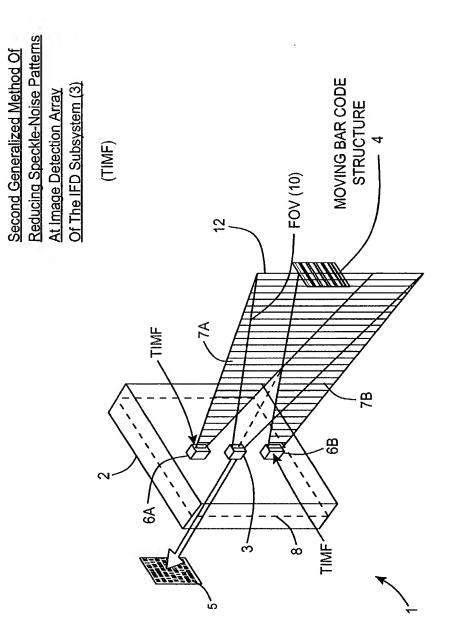


FIG. 1113

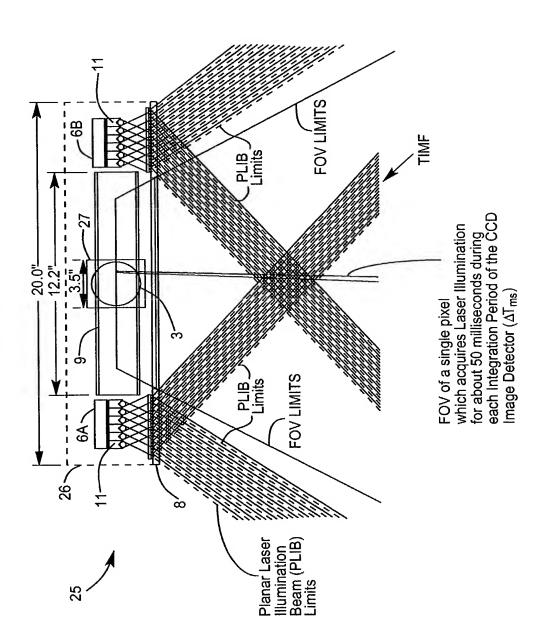


FIG. 1113A

# THE SECOND GENERALIZED SPECKLE-NOISE PATTERN REDUCTION METHOD OF THE PRESENT INVENTION

Prior to illumination of the target with the planar laser illumination beam (PLIB), modulate the temporal intensity of the transmitted PLIB along the planar extent thereof according to a temporal intensity modulation function (TIMF) so as to produce numerous substantially different timevarying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.

Temporally average the numerous substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photointegration time period thereof, so as to thereby reduce the power of the speckle-noise pattern observed at the image detection array.

В

FIG. 1113B

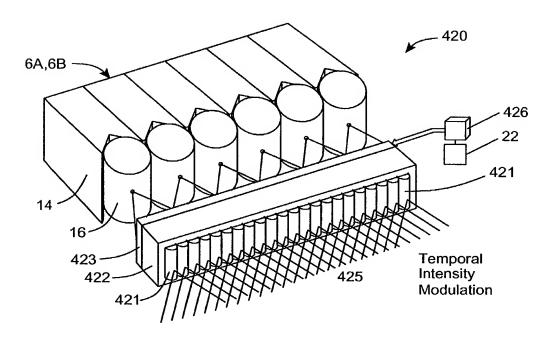
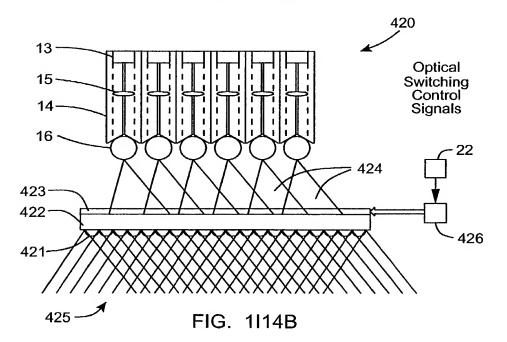


FIG. 1114A



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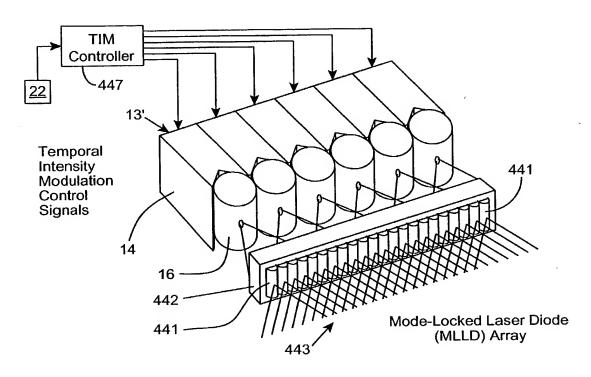


FIG. 1115A

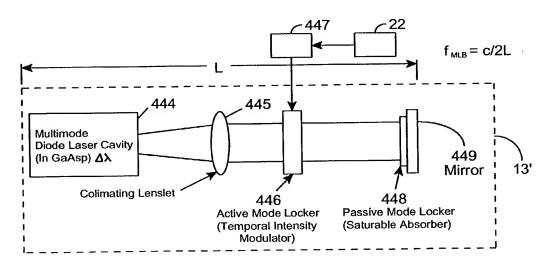


FIG. 1115B

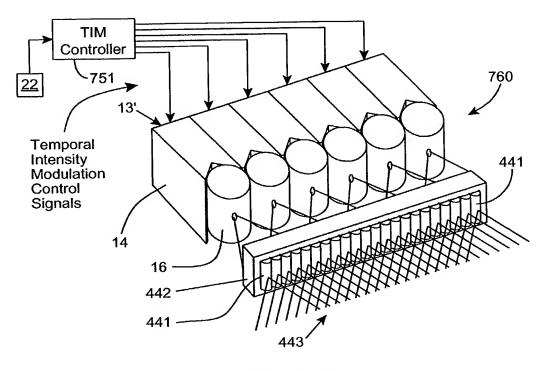
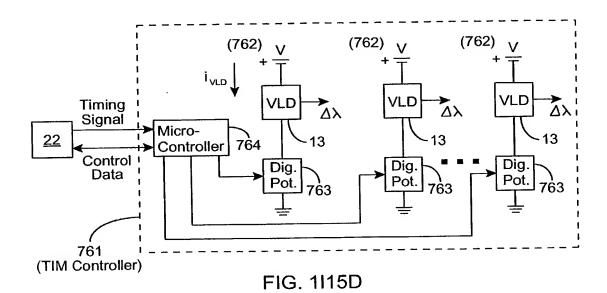


FIG. 1115C



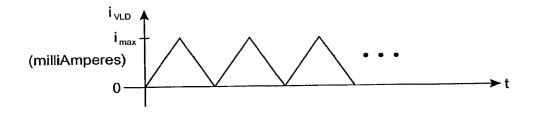


FIG. 1115E

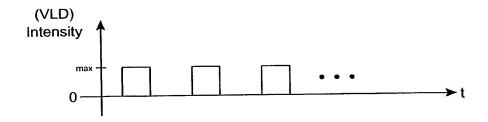


FIG. 1115F

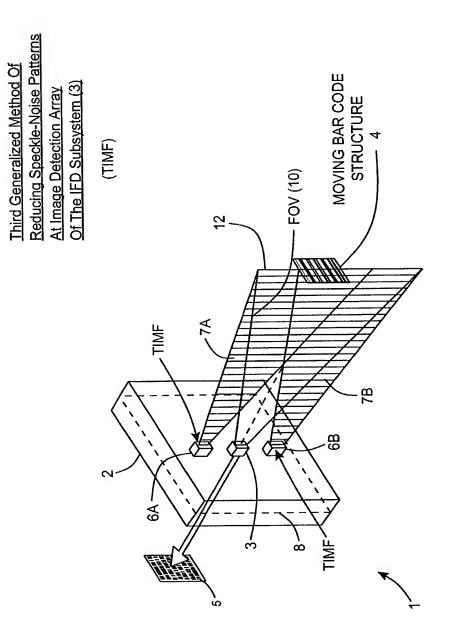


FIG. 1116

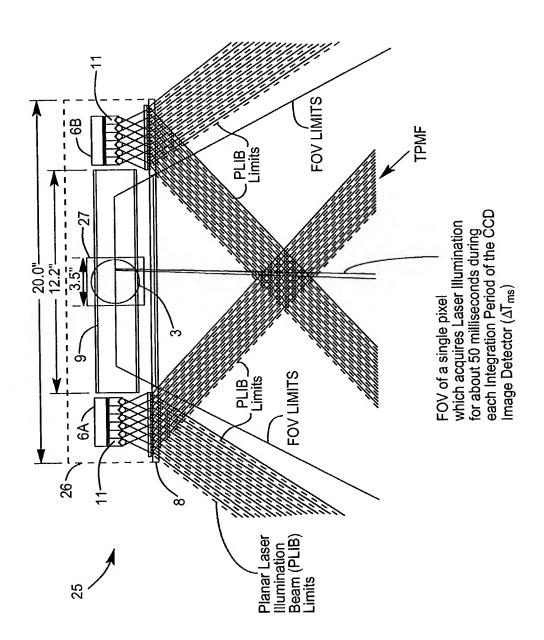


FIG. 1116A

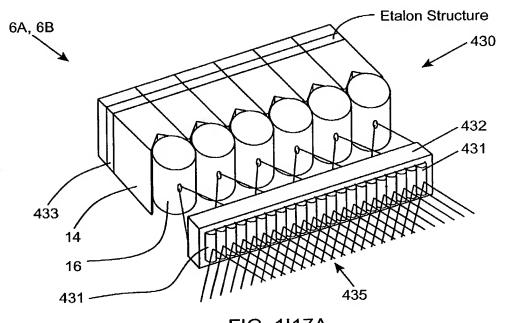
#### THE THIRD GENERALIZED SPECKLE-NOISE PATTERN REDUCTION METHOD OF THE PRESENT INVENTION

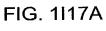
Prior to illumination of the target with the planar laser illumination beam (PLIB), modulate the temporal phase of the transmitted PLIB according to a temporal phase modulation function (TPMF) so as to produce numerous substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.

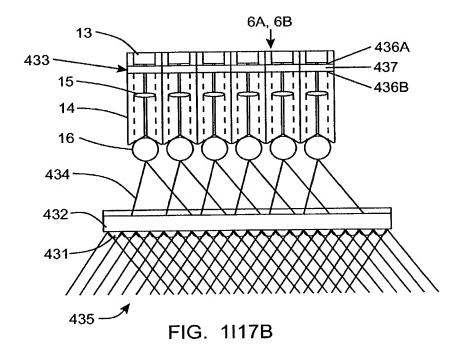
Temporally average the numerous substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce the power of the speckle-noise pattern observed at the image detection array.

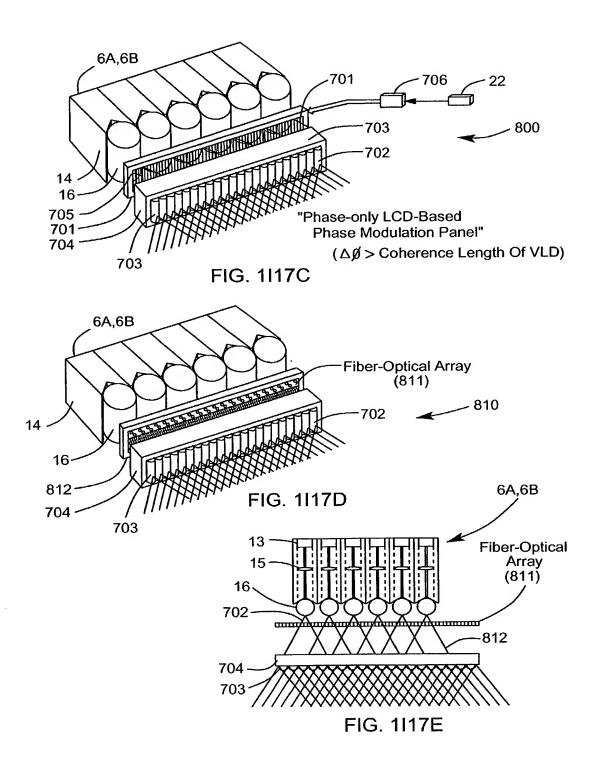
В

FIG. 1116B









Fourth Generalized Method Of Reducing Speckle-Noise Patterns At Image Detection Array Of The IFD Subsystem (3)

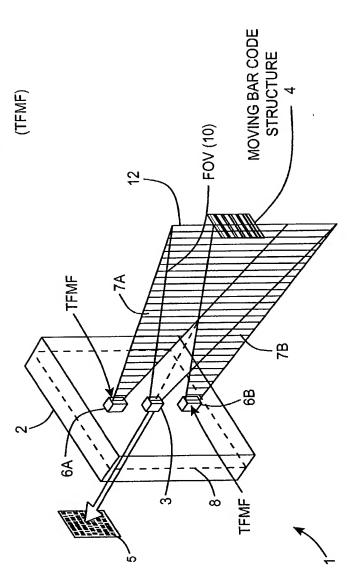


FIG. 1118

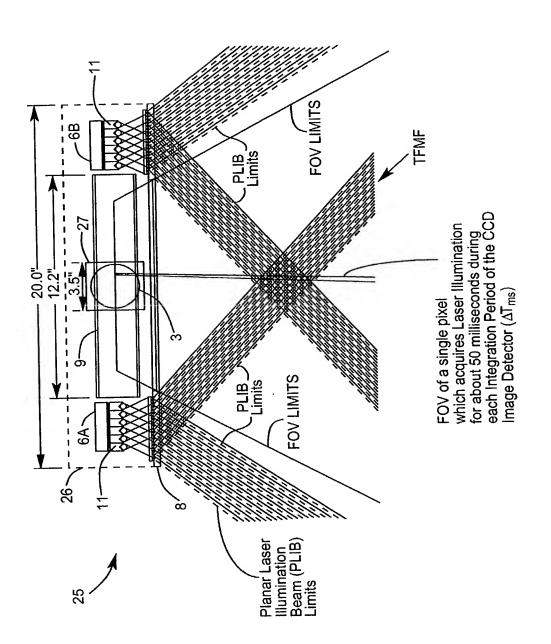


FIG. 1118A

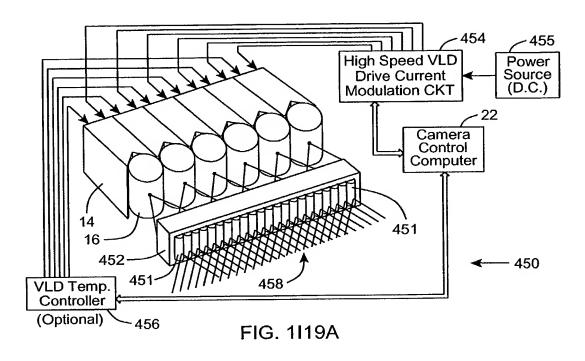
# THE FOURTH GENERALIZED SPECKLE-NOISE PATTERN REDUCTION METHOD OF THE PRESENT INVENTION

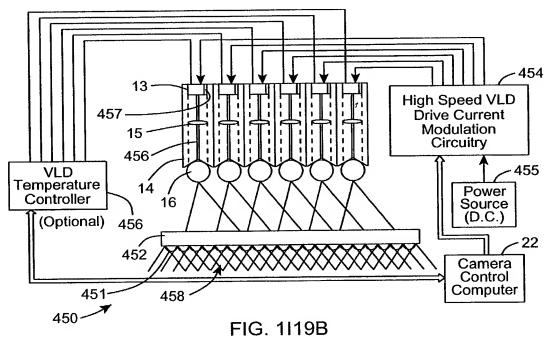
Prior to illumination of the target with the planar laser illumination beam (PLIB), modulate the temporal frequency of the transmitted PLIB along the planar extent thereof according to a temporal intensity modulation function (TIMF) so as to produce numerous substantially different timevarying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.

Temporally average the numerous substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce the power of the speckle-noise pattern observed at the image detection array.

`B

FIG. 1118B





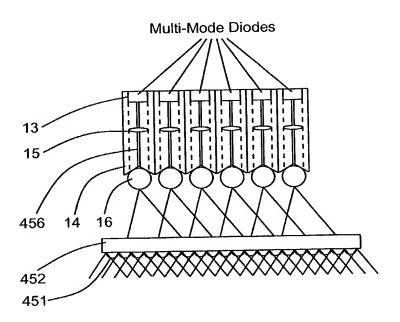


FIG. 1119C

Reducing Speckle-Noise Patterns Fifth Generalized Method Of MOVING BAR CODE STRUCTURE At Image Detection Array Of The IFD Subsystem (3) (SIMF) - FOV (10) 12 SIMF <del>6</del>B SIMF.

FIG. 1120

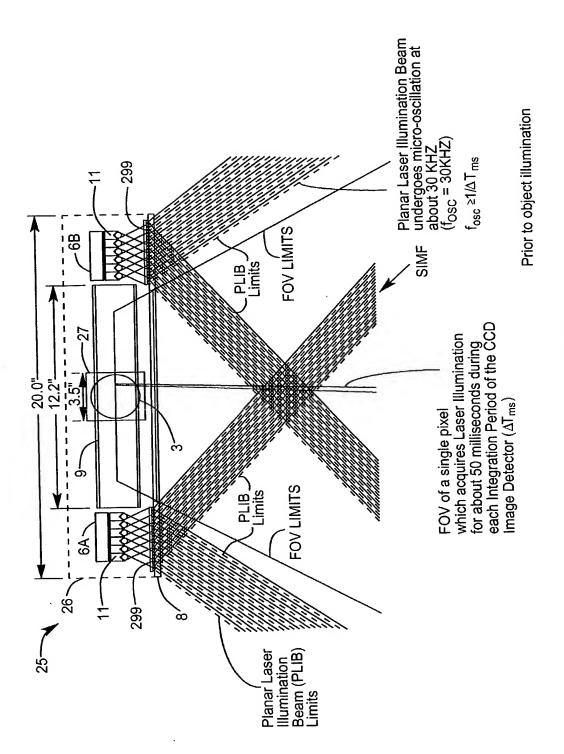


FIG. 1120A

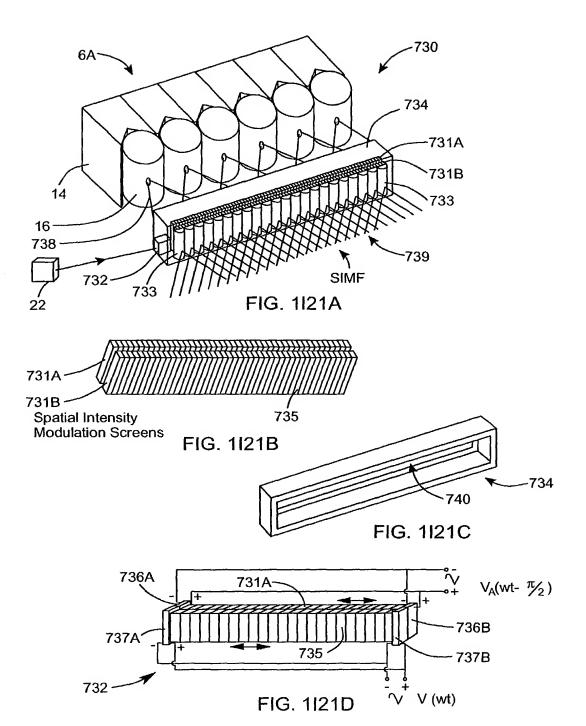
В

## THE FIFTH GENERALIZED SPECKLE-NOISE PATTERN REDUCTION METHOD OF THE PRESENT INVENTION

Prior to illumination of the target with the planar laser illumination beam (PLIB), modulate the spatial intensity of the transmitted PLIB along the planar extent thereof according to a spatial intensity modulation function (SIMF) so as to produce numerous substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.

Temporally average the numerous substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce the power of the speckle-noise pattern observed at the image detection array.

FIG. 1120B



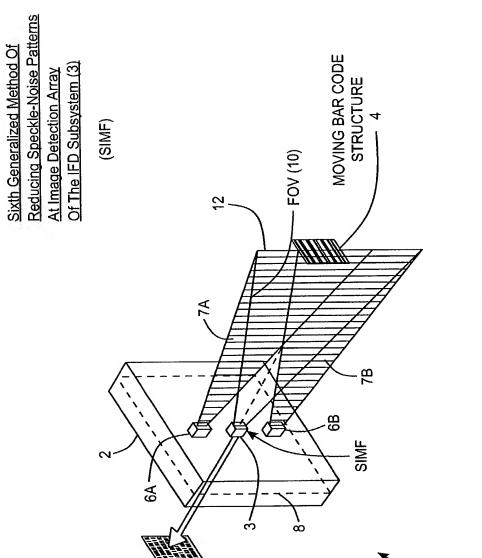


FIG. 1122

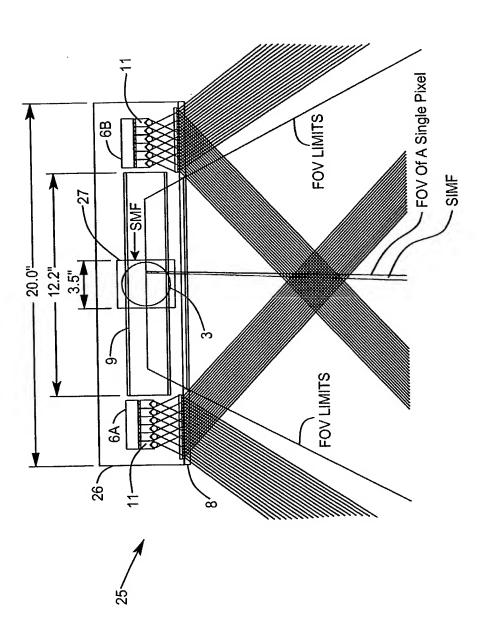


FIG. 1122A

## THE SIXTH GENERALIZED SPECKLE-NOISE PATTERN REDUCTION METHOD OF THE PRESENT INVENTION

After illumination of the target with the planar laser illumination beam (PLIB), modulate the spatial intensity of the reflected/scattered (i.e. received) PLIB along the planar extent thereof according to a spatial intensity modulation function (SIMF) so as to produce numerous substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.

Temporally average the many substantially different timevarying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photointegration time period thereof, so as to thereby reduce the speckle-noise pattern observed at the image detection array.

В

FIG. 1122B

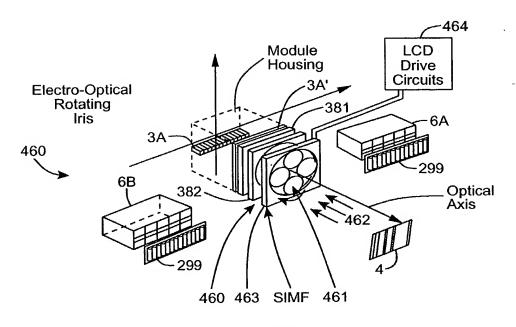


FIG. 1123A

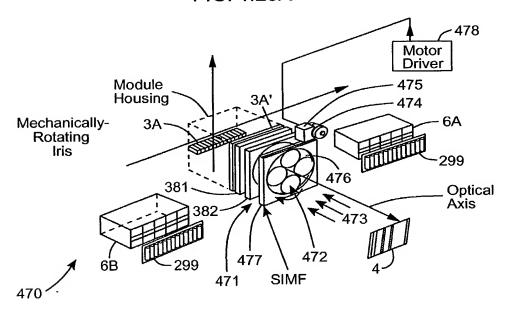


FIG. 1123B

. . . . .

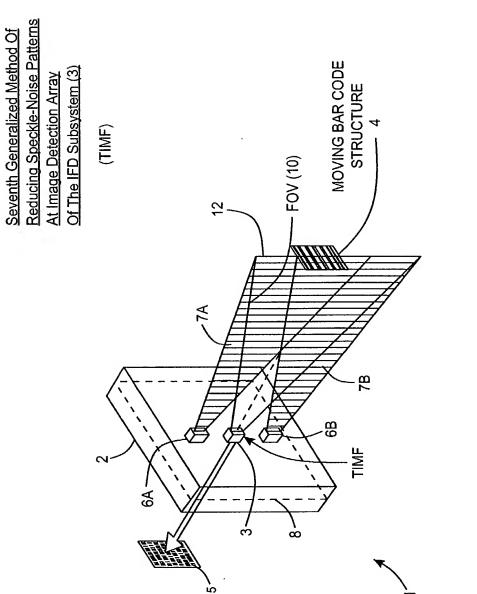


FIG. 1124

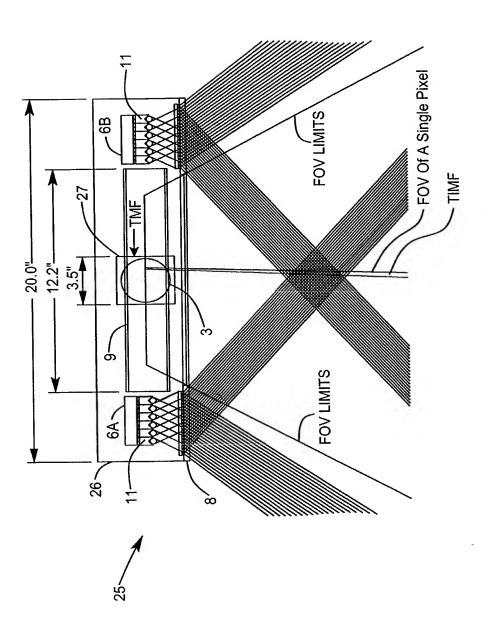


FIG. 1124A

В

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## THE SEVENTH GENERALIZED SPECKLE-NOISE PATTERN REDUCTION METHOD OF THE PRESENT INVENTION

After illumination of the target with the planar laser illumination beam (PLIB), modulate the temporal intensity of the reflected/scattered (i.e. received) PLIB along the planar extent thereof according to a temporal intensity modulation function (TIMF) so as to produce many substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.

Temporally average the many substantially different timevarying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photointegration time period thereof, so as to thereby reduce the speckle-noise pattern observed at the image detection array.

FIG. 1124B

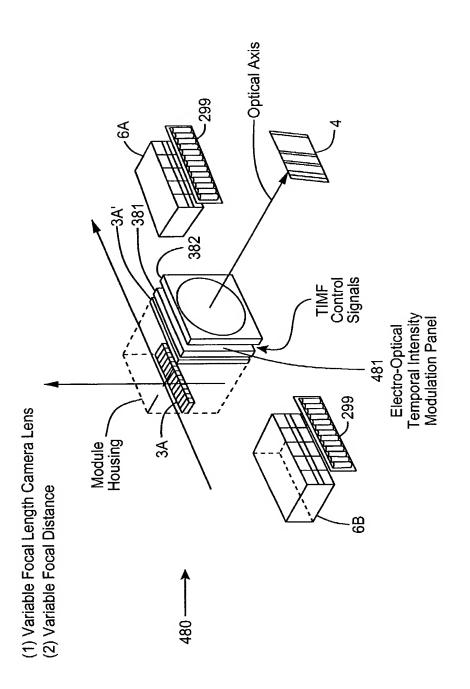


FIG. 1124C

#### THE EIGHT GENERALIZED SPECKLE-NOISE PATTERN REDUCTION METHOD OF THE PRESENT INVENTION

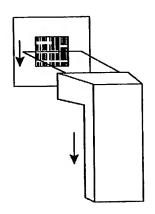
Use a PLIIM-BASED Imager to produce a series of consecutively captured digital images of an object over a series of photo-integration time periods of the PLIIM-Based Imager, wherein each digital image of the object includes a substantially different speckle noise pattern produced by natural oscillatory micro-motion and/or forced oscillatory micro-movementof the Imager relative to the object during operation of the PLIIM-Based Imager.

Store the series of consecutively captured digital images of the object in buffer memory within the PLIIM-Based Imager.

B

Add relatively small (e.g. 3x3) windowed image processing filters to the additively combine and average the pixel data in the series of consecutively captured digital images so as to produce a reconstructed digital image having a speckle noise pattern with reduced RMS power.

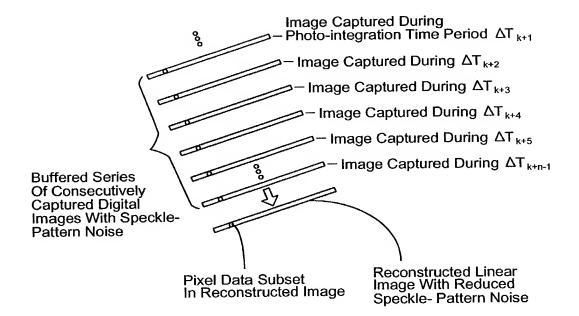
FIG. 1124D



Manual Sweeping Action Across Code Symbol Or Graphical Indicia

FIG. 1124E

. . . .



Case: Linear Imager

FIG. 1124F

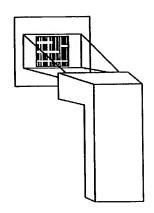
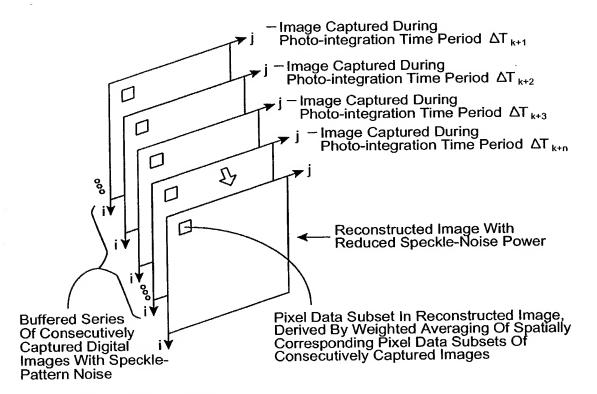


FIG. 1124G



Case: 2D Area Imager

FIG. 1124H

## THE NINTH GENERALIZED METHOD OF REDUCING SPECKLE PATTERN NOISE IN PLIIM-BASED IMAGING SYSTEMS

During each photo-integration time period of a PLIM-Based Imager, produce numerous substantially different spatially-varying speckle noise pattern elements (i.e. speckle noise pattern elements at different points) on each image detection element in the image detection array of the PLIIM-Based Imager.

Spatially (and temporally) average said spatially-varying specklenoise pattern elements over the spatial area of each image detection element, thereby reducing the RMS power of specklepattern noise observed in said PLIM-Based Imager.

`B

FIG. 11241

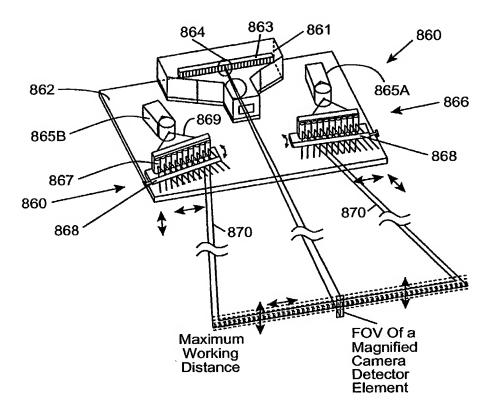


FIG. 1125A1

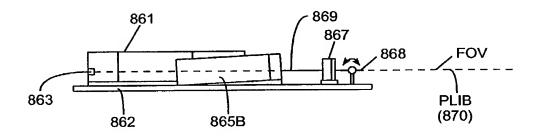


FIG. 1125A2

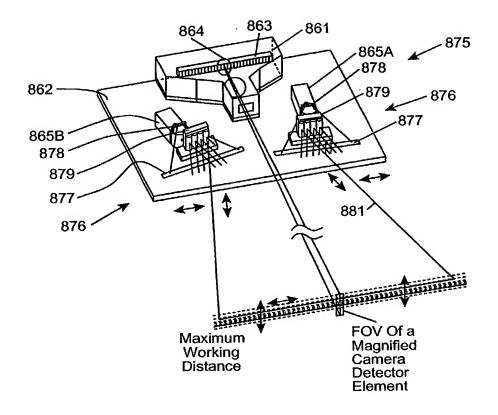


FIG. 1125B1

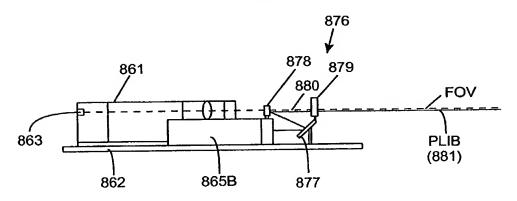


FIG. 1125B2

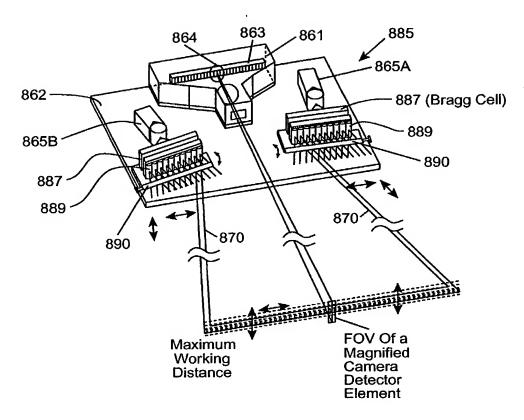


FIG. 1125C1

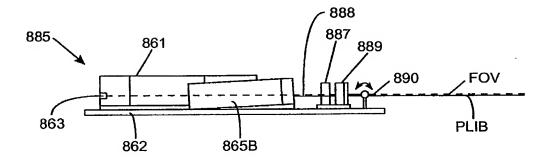


FIG. 1125C2

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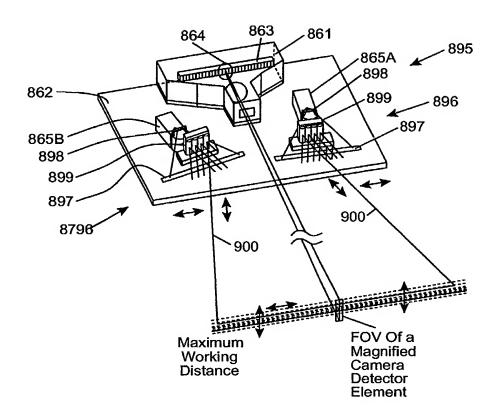


FIG. 1125D1

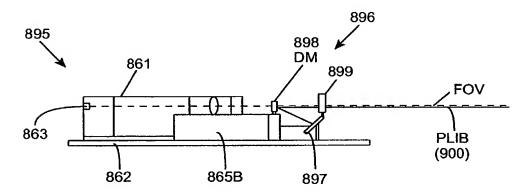
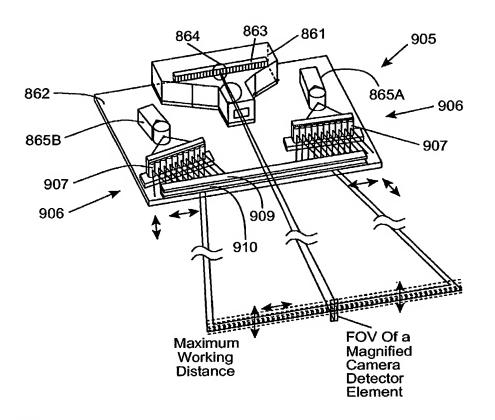


FIG. 1125D2



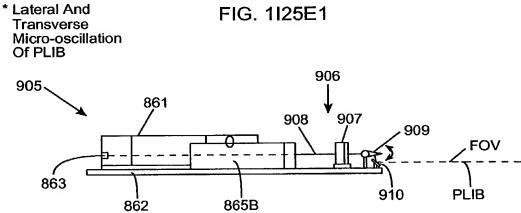


FIG. 1125E2

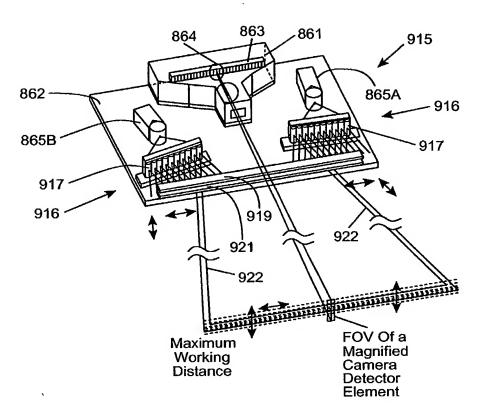


FIG. 1125F1

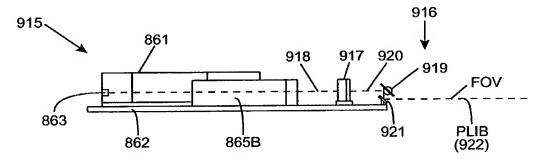


FIG. 1125F2

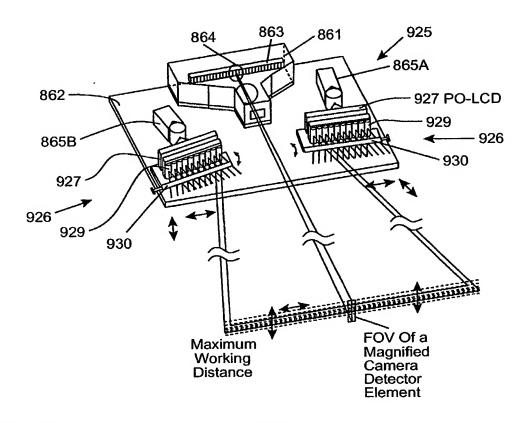


FIG. 1125G1

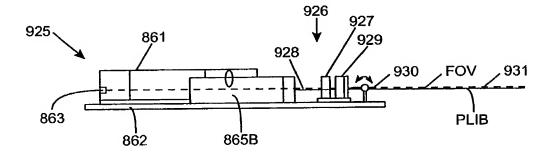


FIG. 1125G2

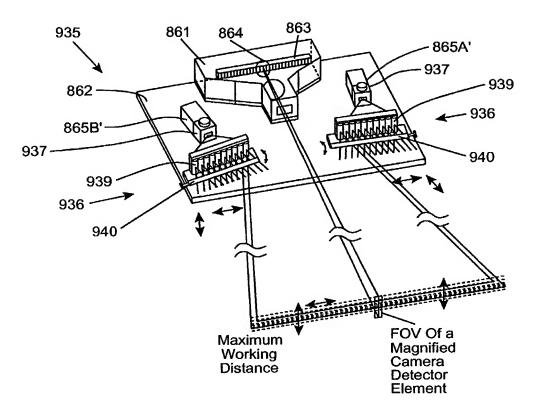


FIG. 1125H1

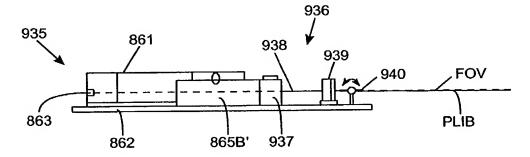


FIG. 1125H2

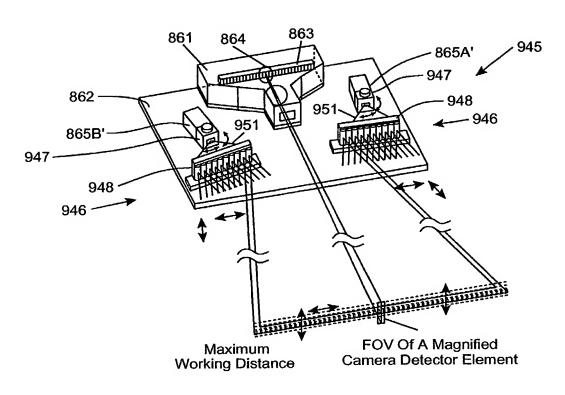


FIG. 112511 \* Lateral And Transverse Micro-oscillation Of PLIB 947 **951** 16 862 -947 949 950 865B' 112513 865B' - 951 949 112513 951 945~ 948

FIG. 112513

FIG. 112512

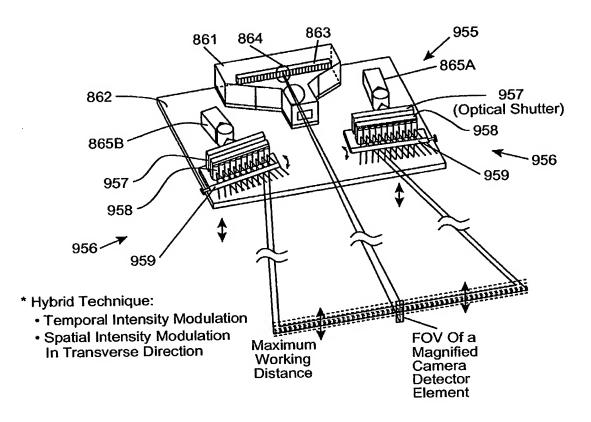


FIG. 1125J1

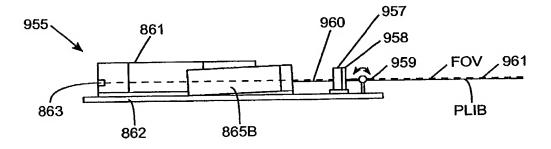


FIG. 1125J2

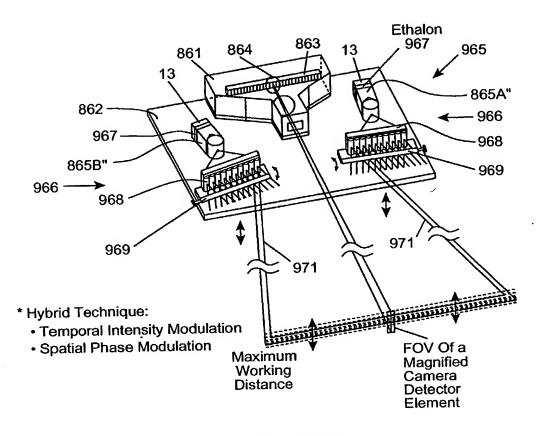


FIG. 1125K1

\* Transverse Micro-oscillation Of PLIB

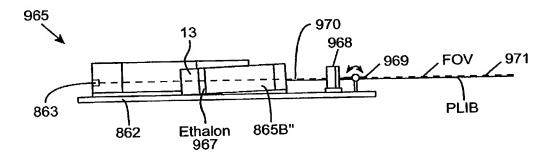
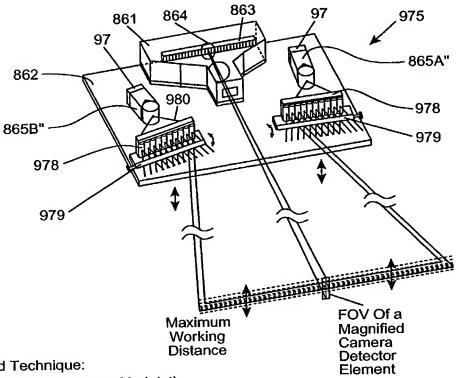


FIG. 1125K2

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- \* Hybrid Technique:
  - Temporal Frequency Modulation
  - Spatial Phase Modulation
- \* Transverse Micro-oscillation Of PLIB

FIG. 1125L1

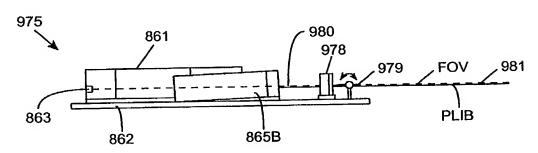
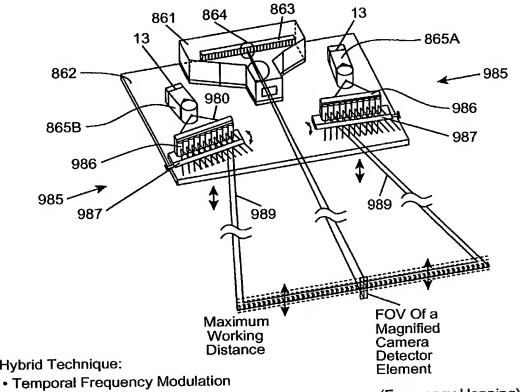


FIG. 1125L2

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\* Hybrid Technique:

- Spatial Phase Modulation

(Frequency Hopping)

\* Transverse Micro-oscillation Of PLIB

FIG. 1125M1

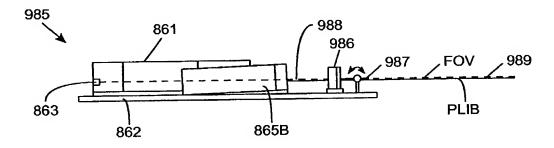
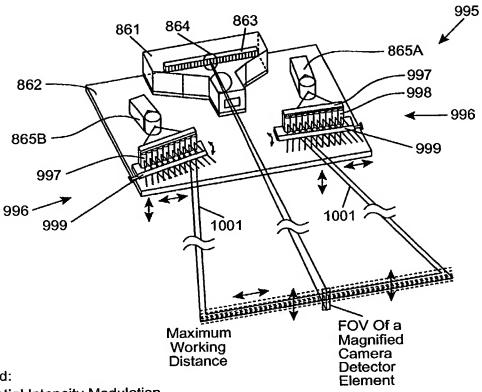


FIG. 1125M2

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- \* Hybrid:
  - Spatial Intensity Modulation
  - Spatial Phase Modulation
- \* Lateral And Transverse Micro-oscillation Of PLIB

FIG. 1125N1

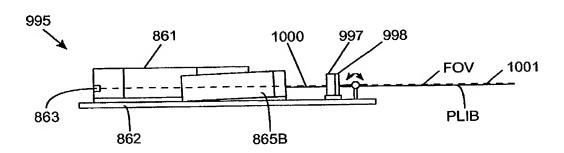


FIG. 1125N2

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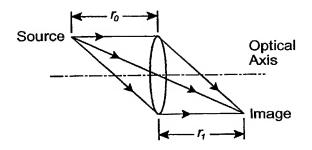


FIG. 1H1

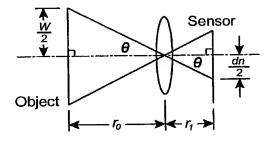


FIG. 1H2

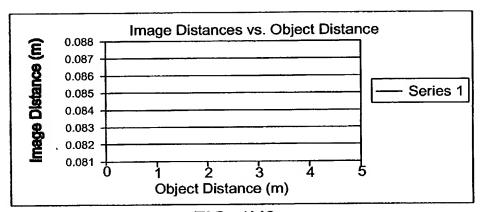


FIG. 1H3

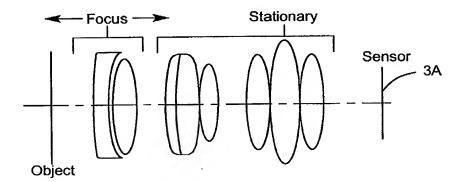


FIG. 1H4

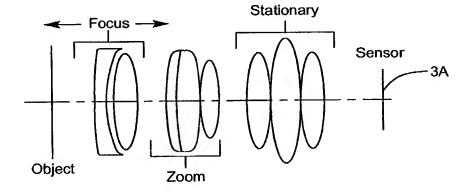


FIG. 1H5

## Fixed Focal Length Lens Cases

7-0

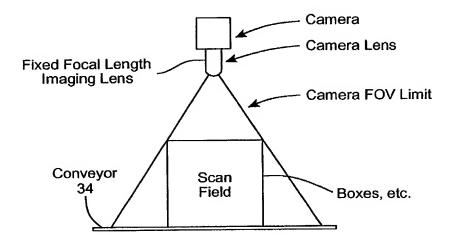


FIG. 1K1

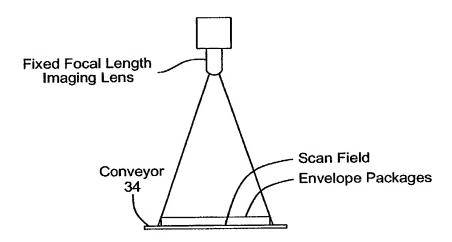


FIG. 1K2

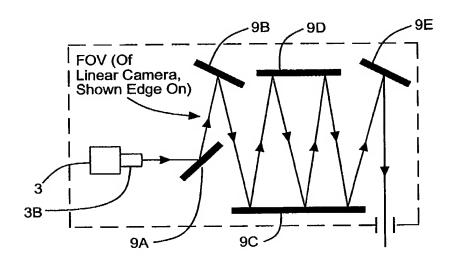


FIG. 1L1

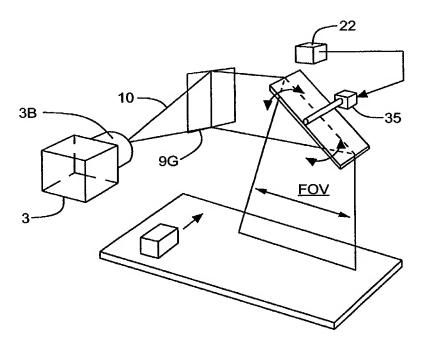


FIG. 1L2

## Pixel Power Density vs. Object Distance (General Example)

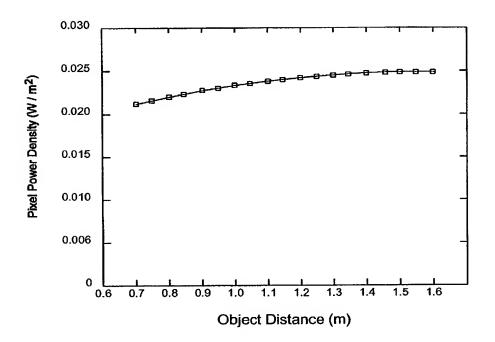


FIG. 1M1

14011

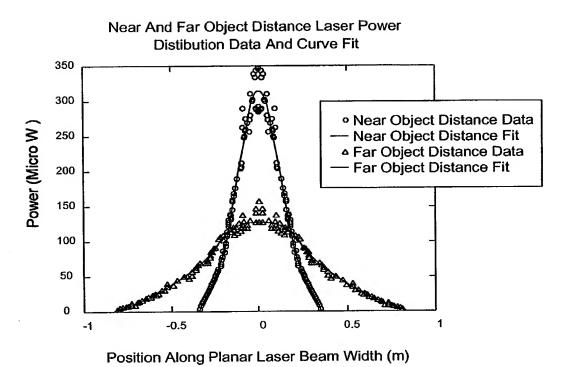


FIG. 1M2

## Planar Laser Beam Width vs. Object Distance

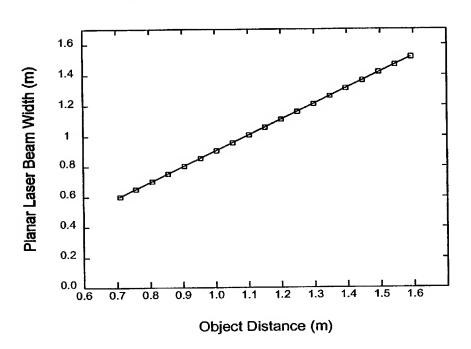


FIG. 1M3

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Planar Laser Beam Height vs.
Object Distance (Far Object Distance Focus)

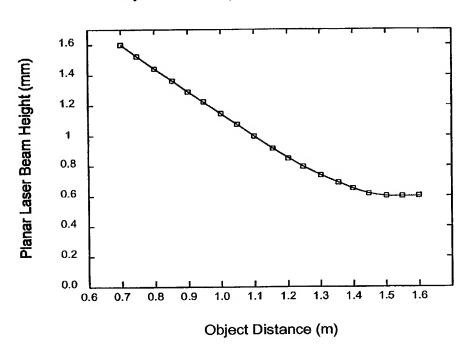


FIG. 1M4

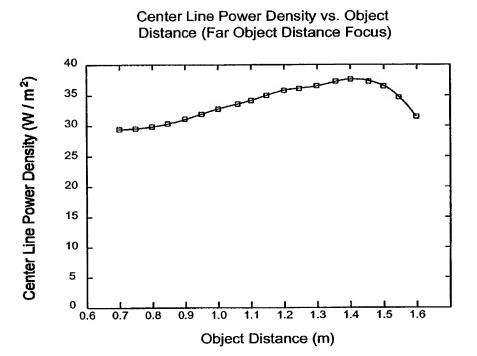


FIG. 1N

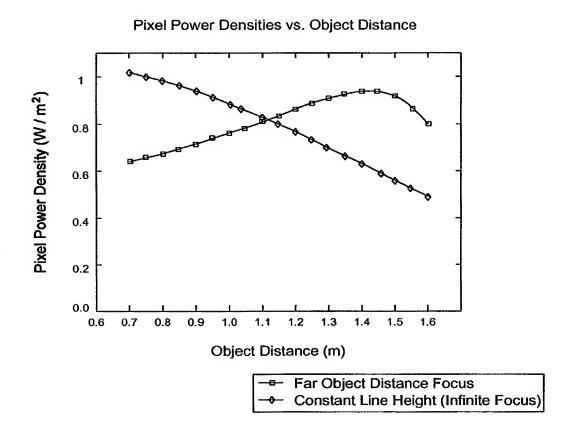


FIG. 10

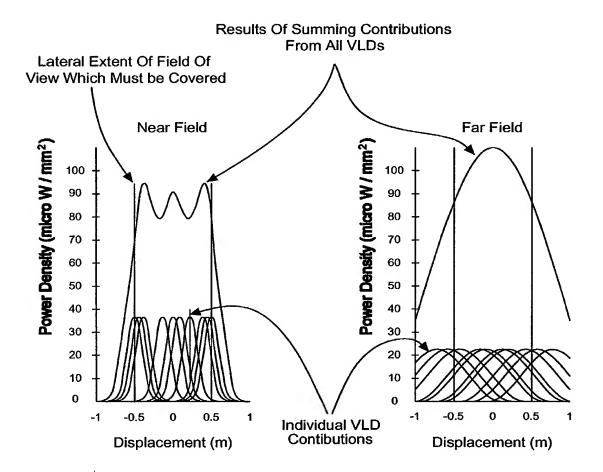


FIG. 1P1

FIG. 1P2

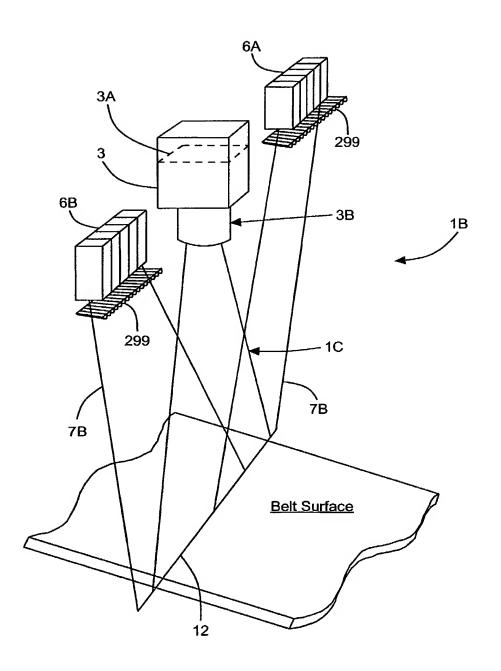
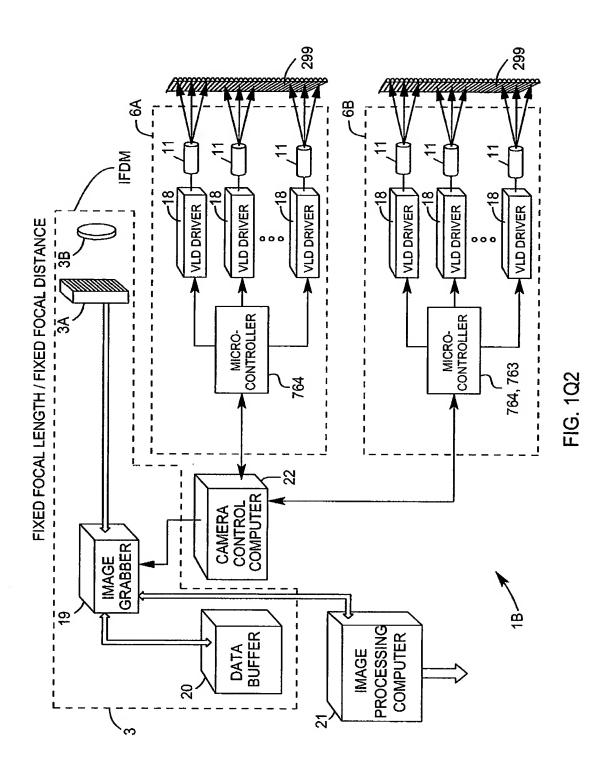


FIG. 1Q1



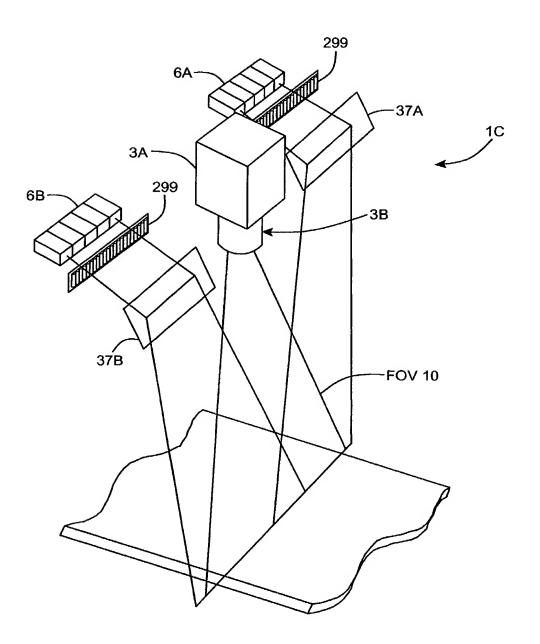
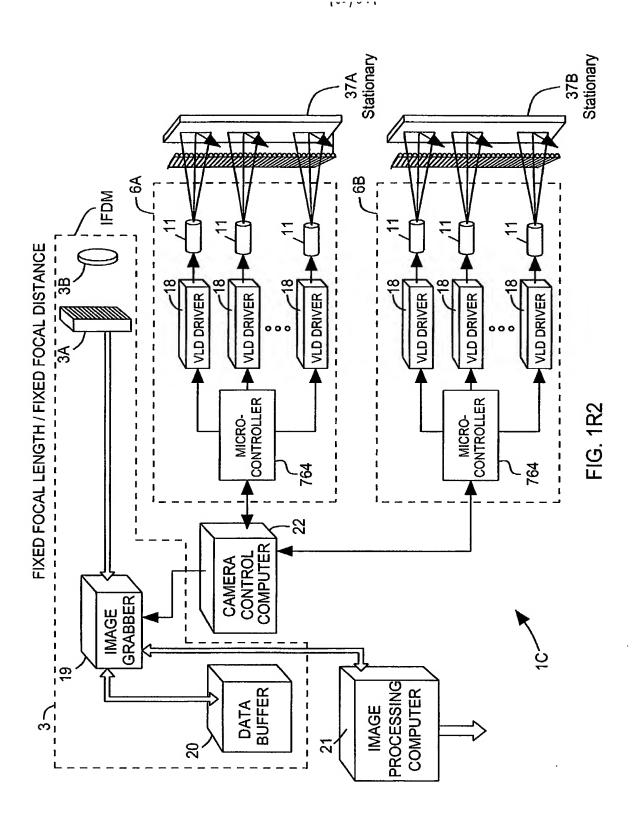


FIG. 1R1



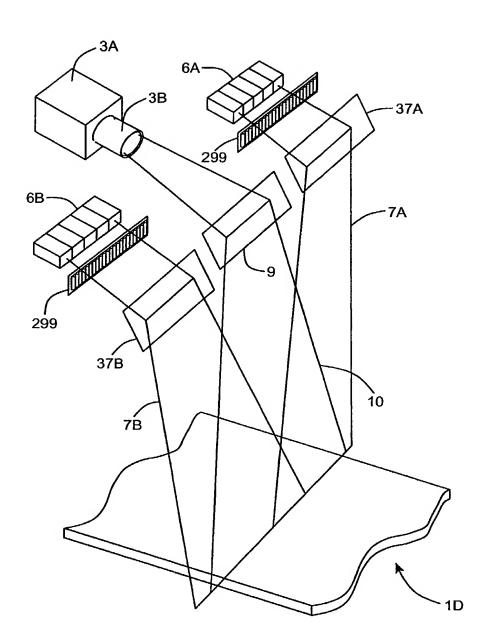
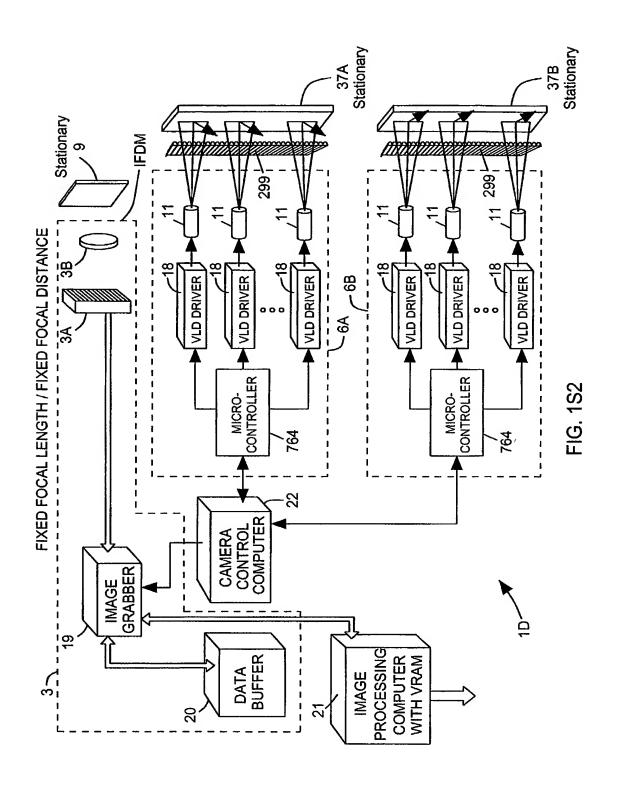


FIG. 1S1



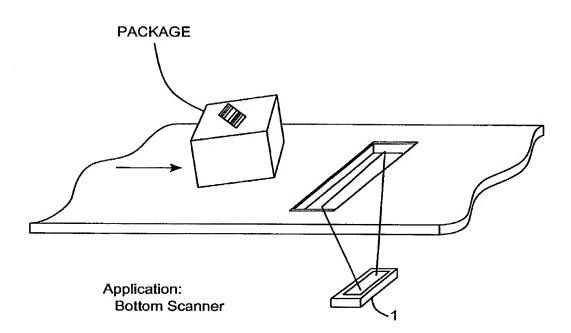


FIG. 1T

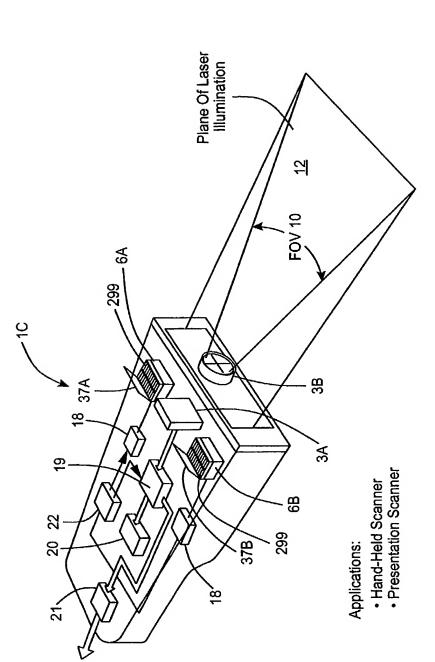


FIG. 10

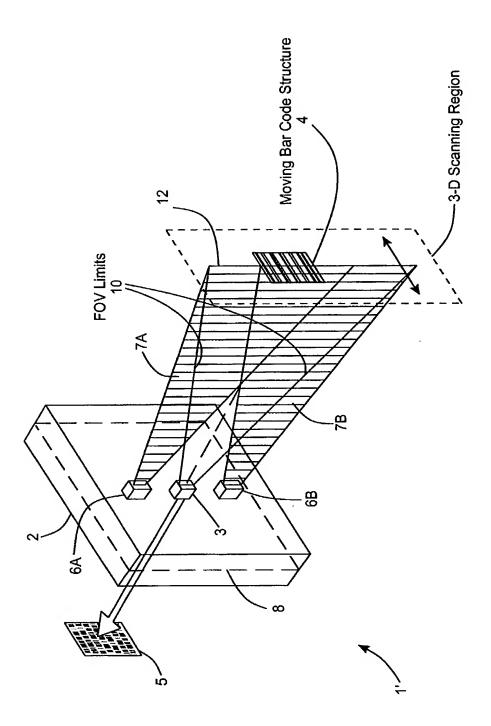


FIG. 1₹

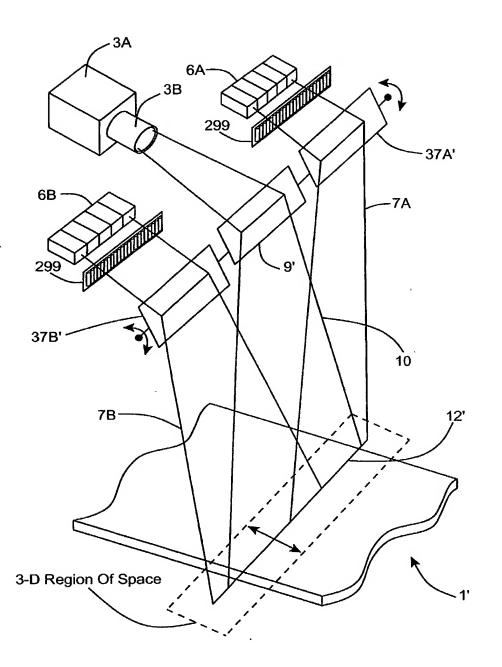


FIG. 1V2,

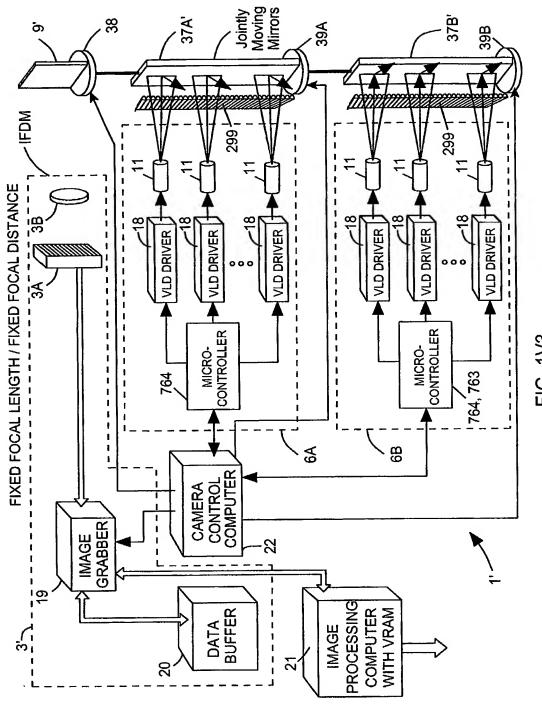


FIG. 1V3

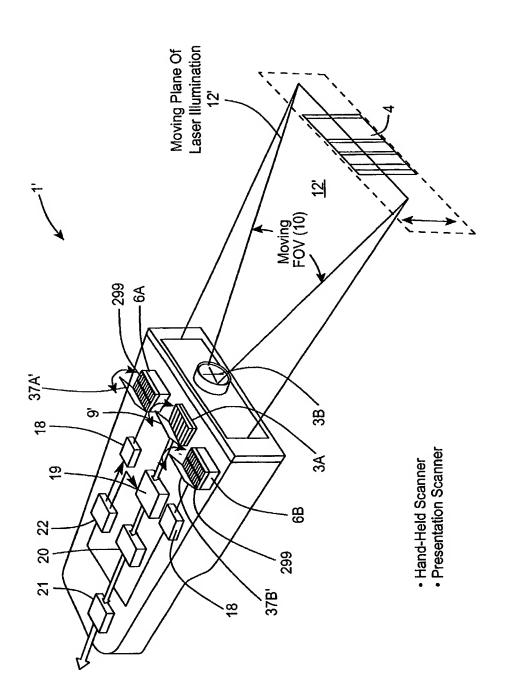


FIG. 1V4

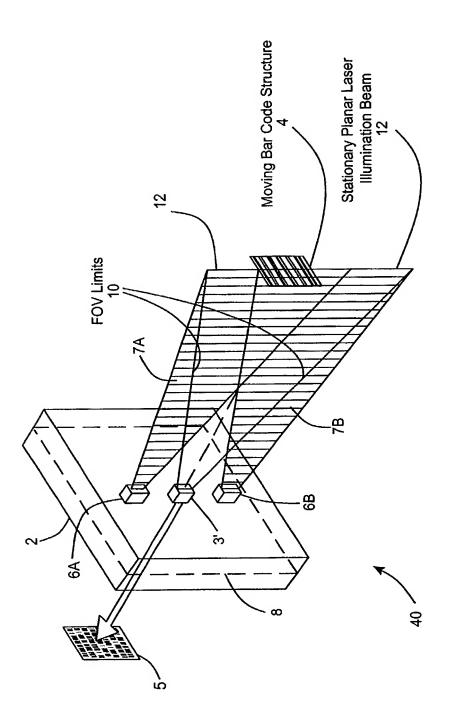


FIG. 24

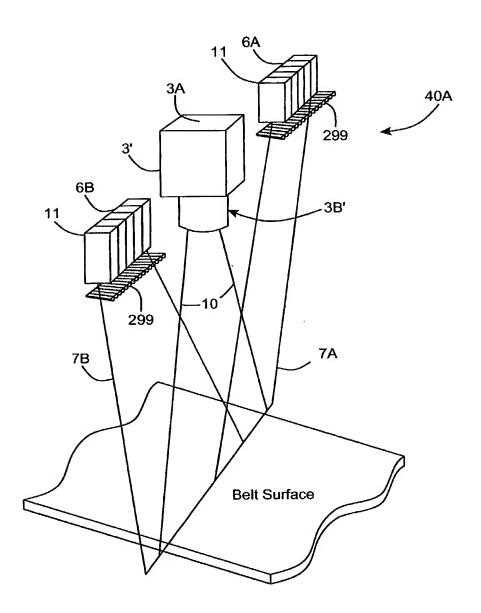
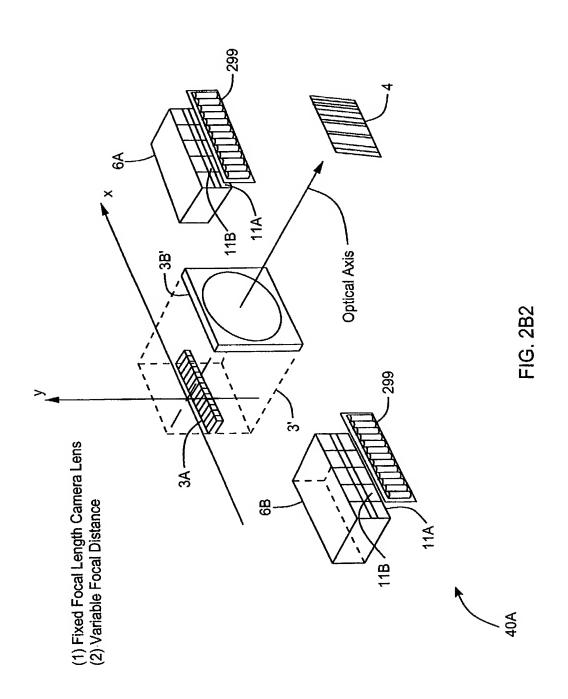
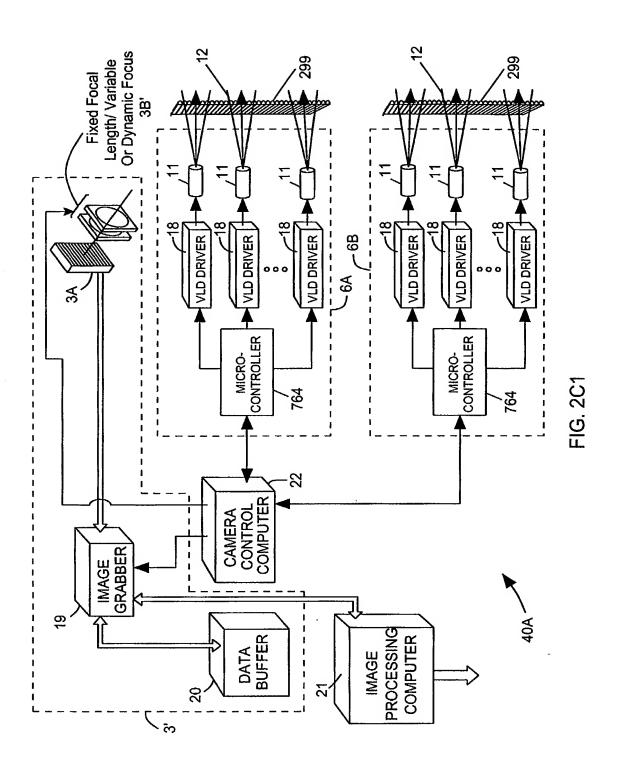


FIG. 2B1





 Fixed Focal Length Imaging Lens
 Variable Or Dynamic Focus Control .3A1 3<u>B</u> 30ģ 끯

FIG. 2C2

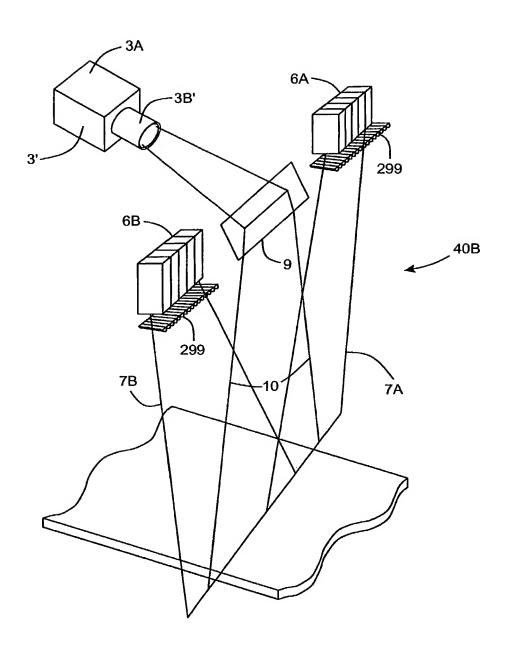
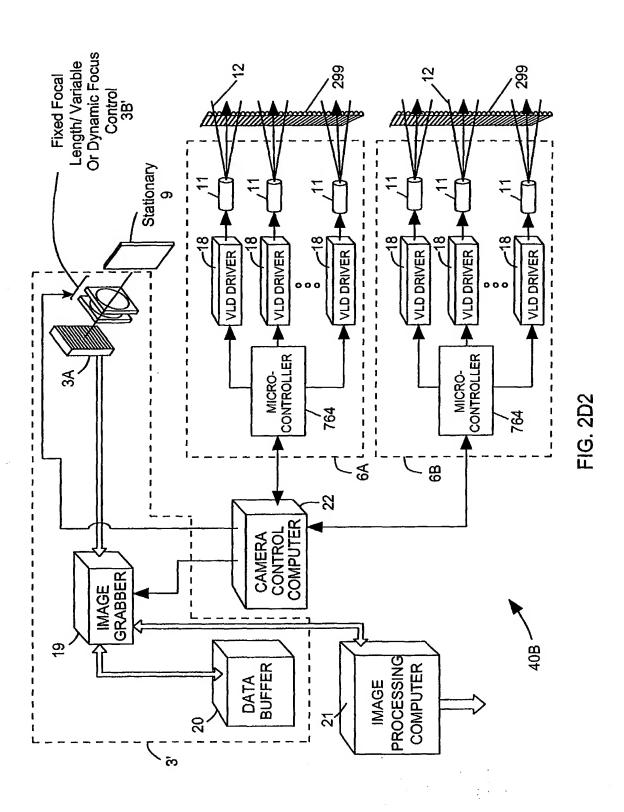


FIG. 2D1





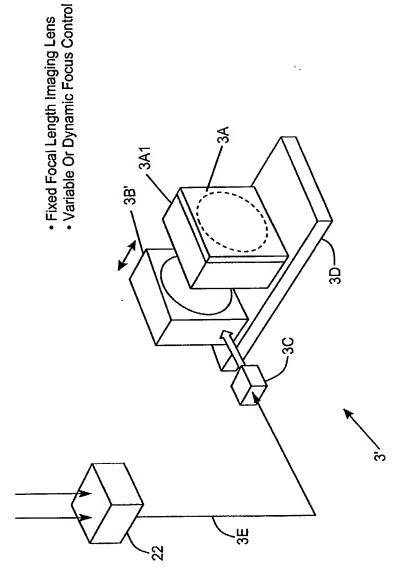


FIG. 2D3

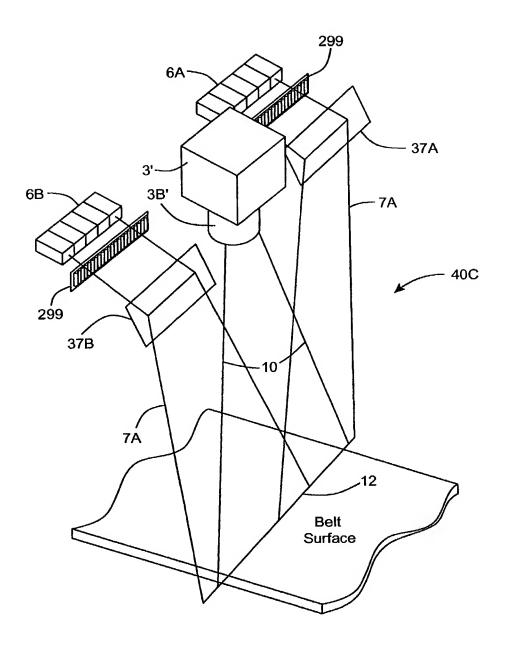
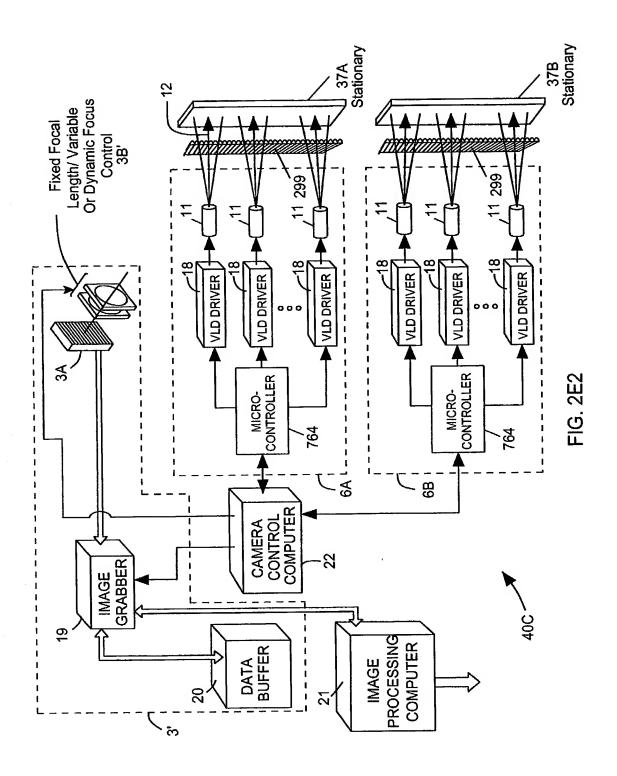


FIG. 2E1



., - . .

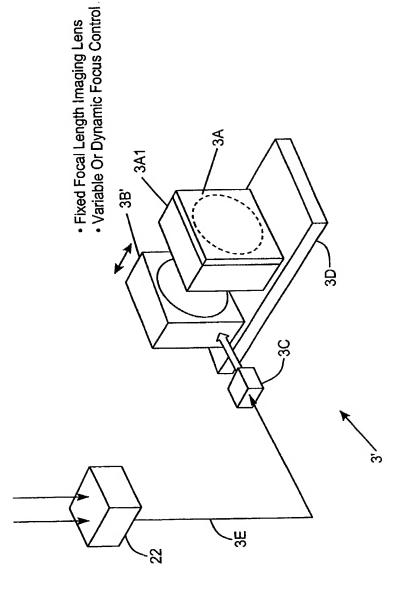


FIG. 2E3

1-4/411

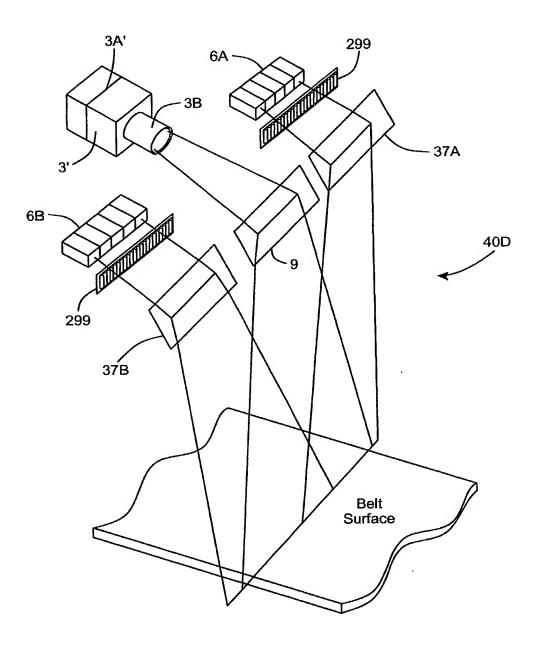
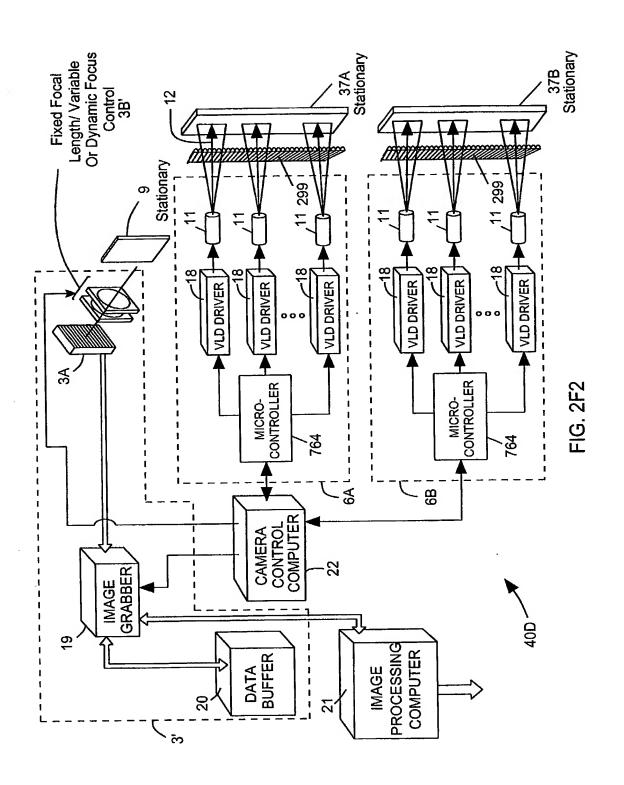


FIG. 2F1

A<sup>3</sup>



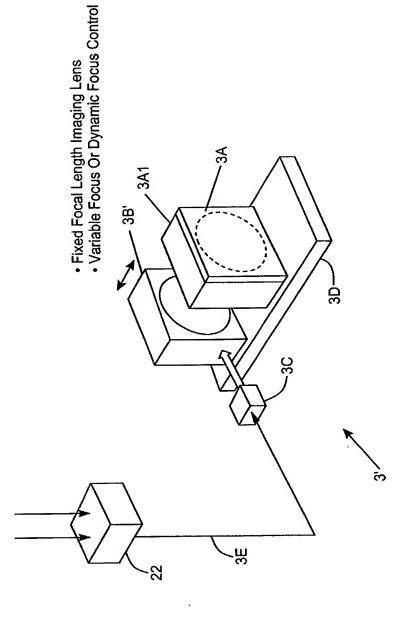


FIG. 2F3

## Top Conveyor Scanner:

- Fixed Focal Length Imaging LensVariable Focal Distance Control

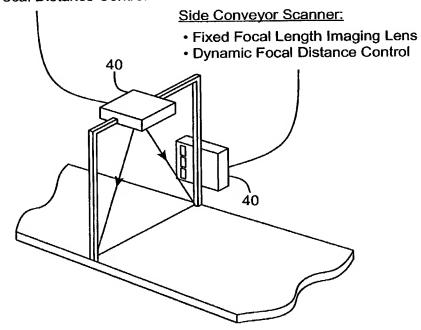


FIG. 2G

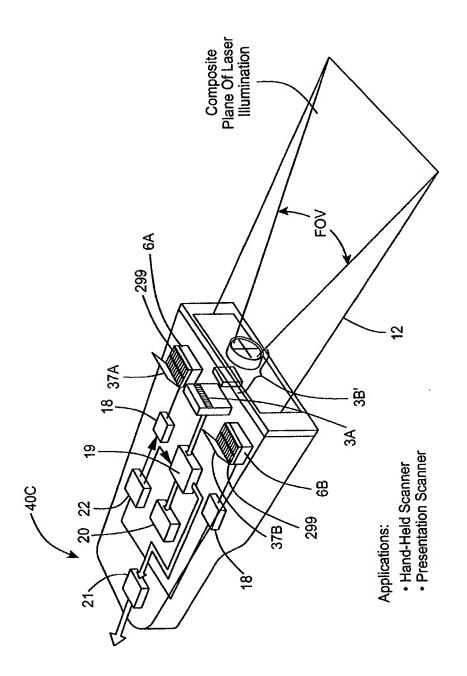


FIG. 2H

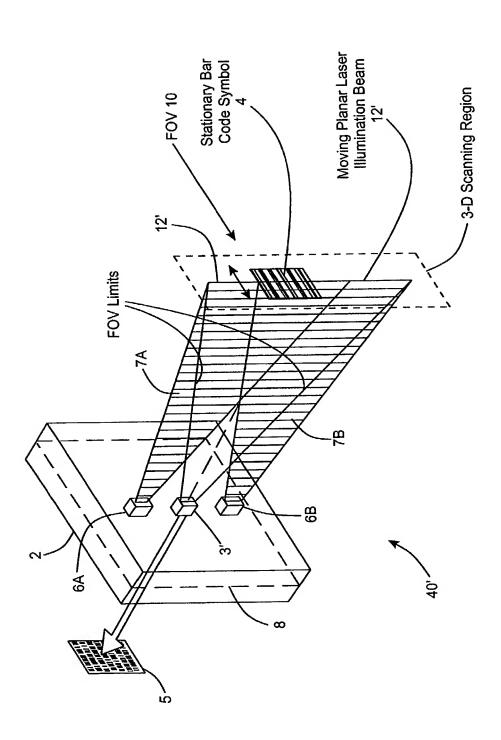


FIG. 211

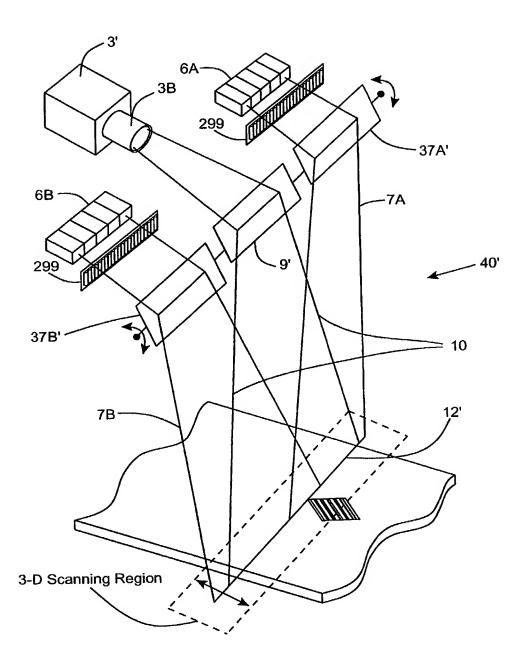
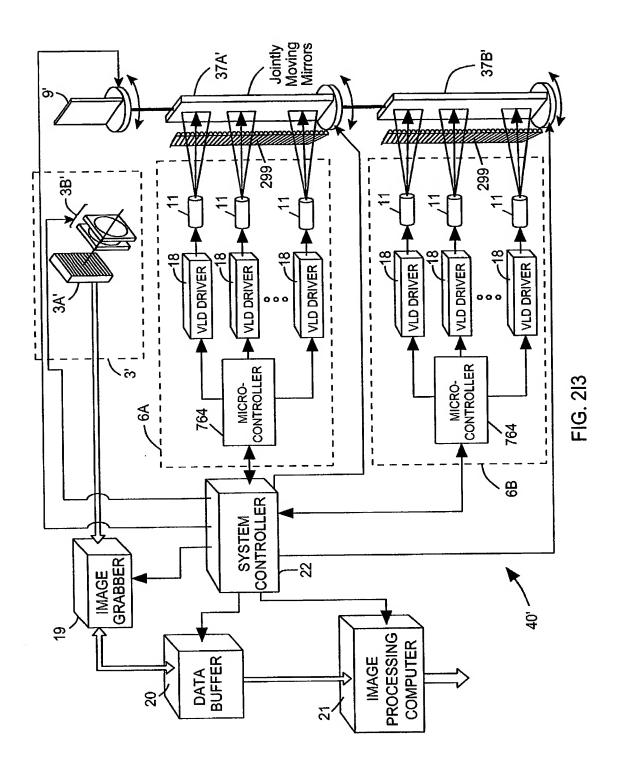


FIG. 212



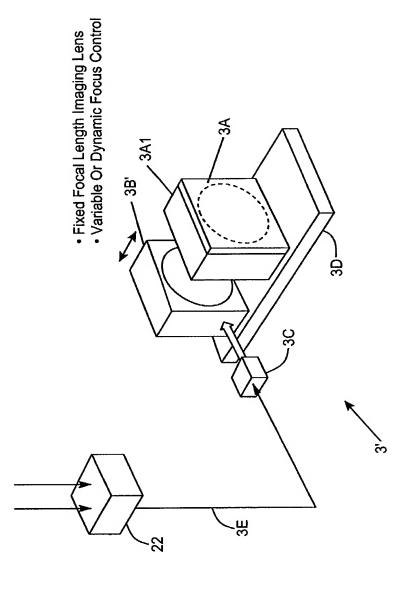


FIG. 214

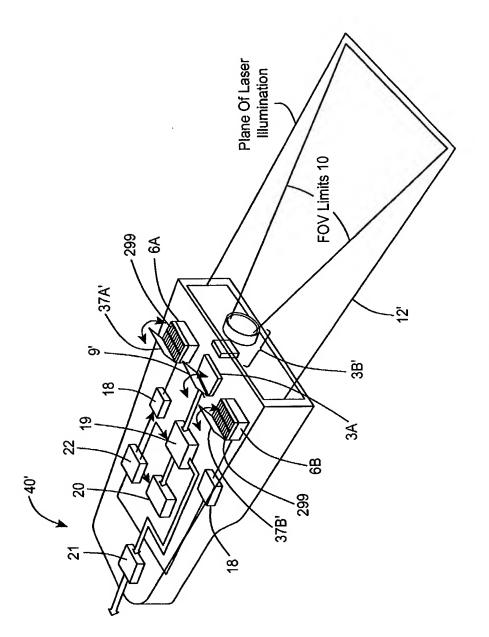


FIG. 215

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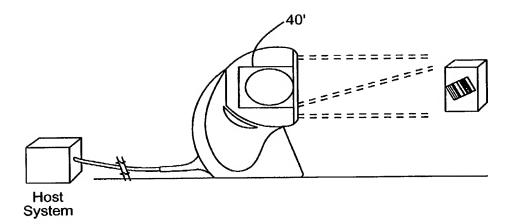


FIG. 216

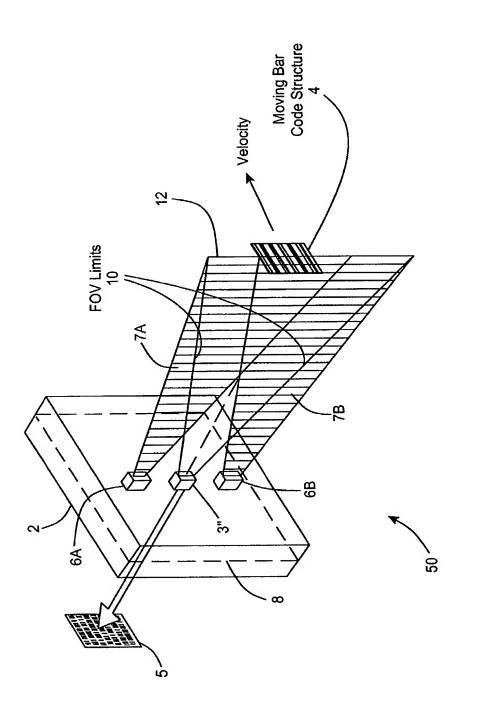


FIG. 3A

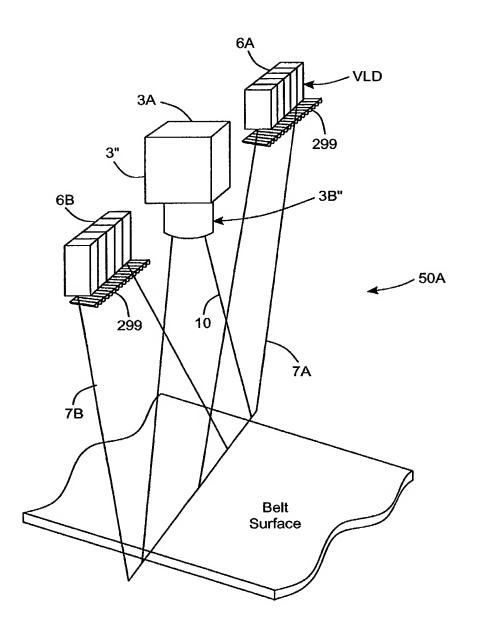


FIG. 3B1

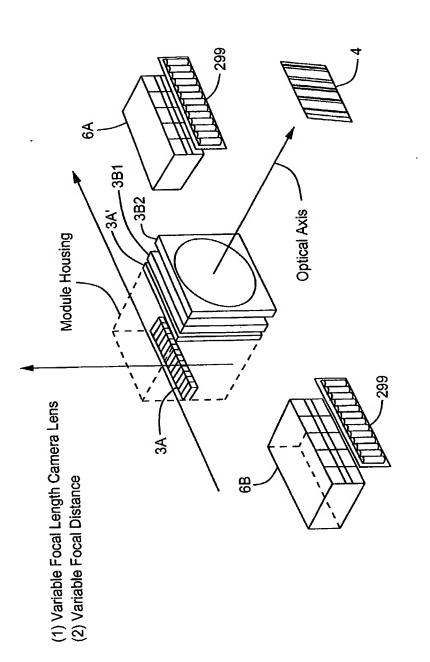
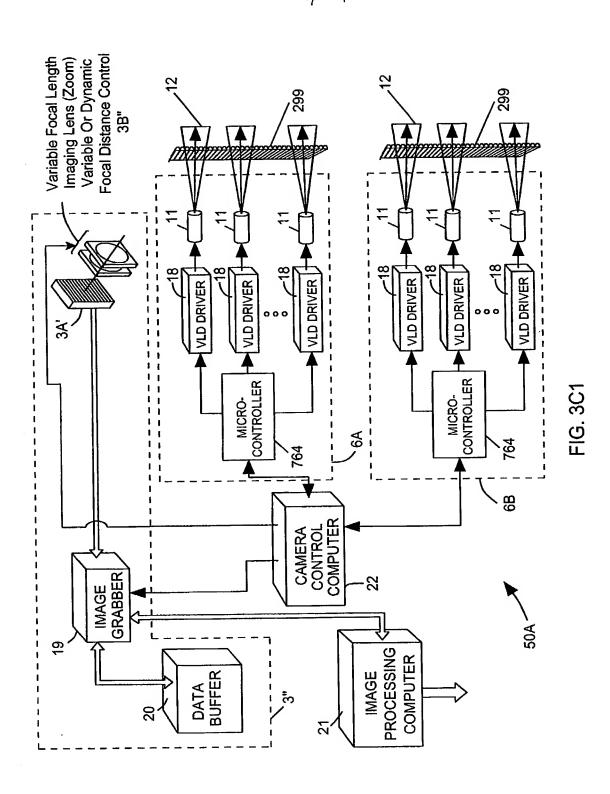


FIG. 3B2



 Variable Focal Length Camera Lens
 Variable Focal Distance Variable Focal Length (Zoom) Control 34 3A1 381 Variable Or Dynamic Focus Control 3B2 302 **√** 3E2 3Ë1 22

FIG. 3C2

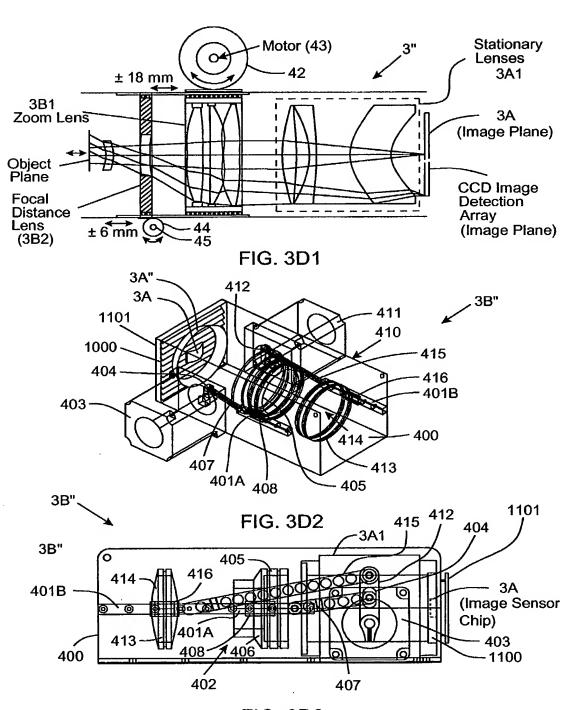


FIG. 3D3

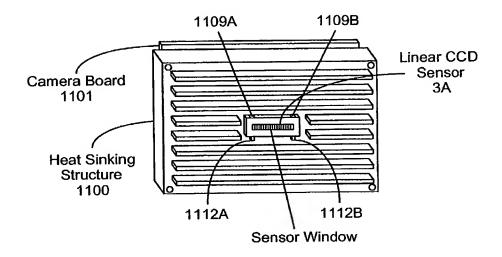


FIG. 3D4

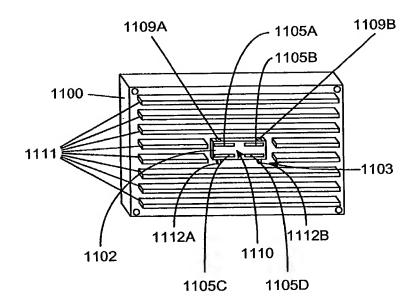


FIG. 3D5

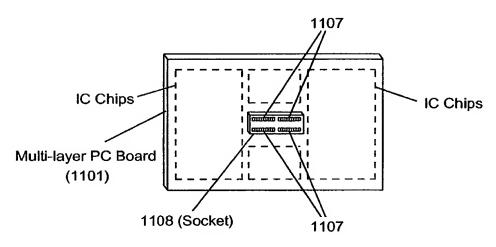


FIG. 3D6

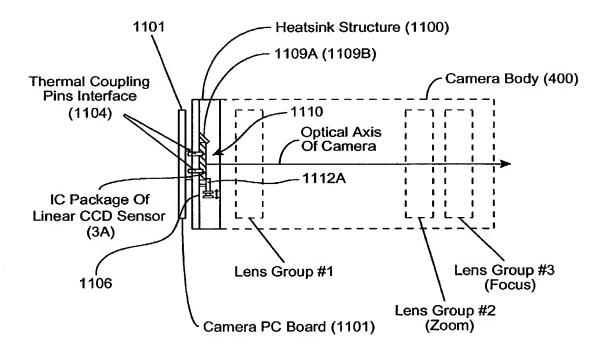


FIG. 3D7

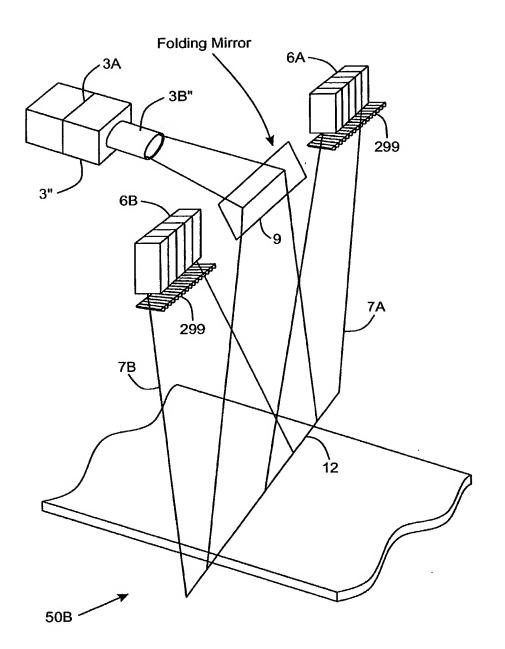
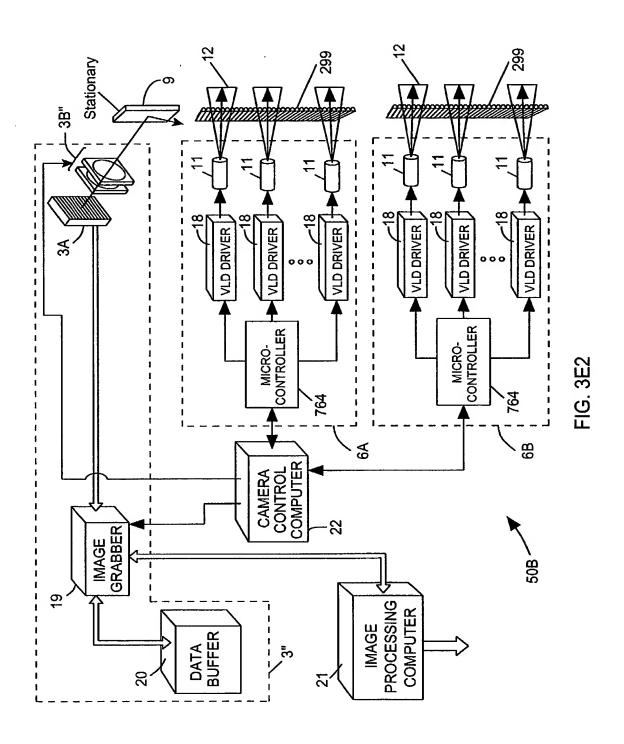


FIG. 3E1

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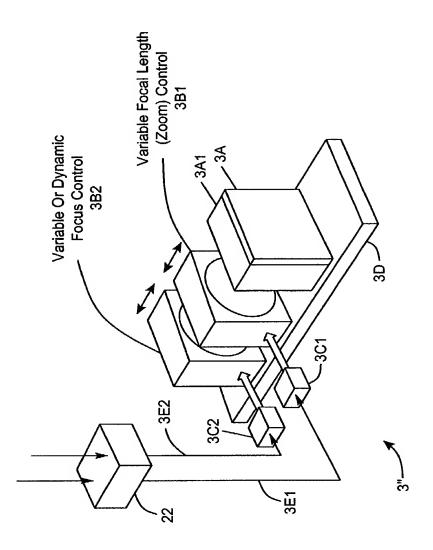


FIG. 3E3

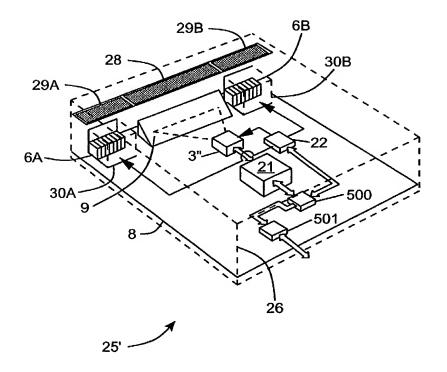


FIG. 3E4

1 -11

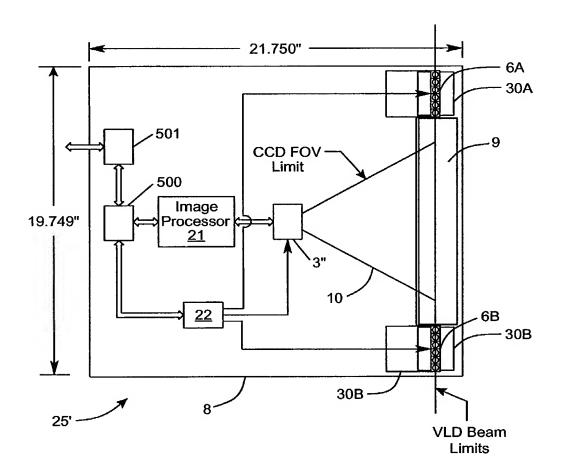


FIG. 3E5

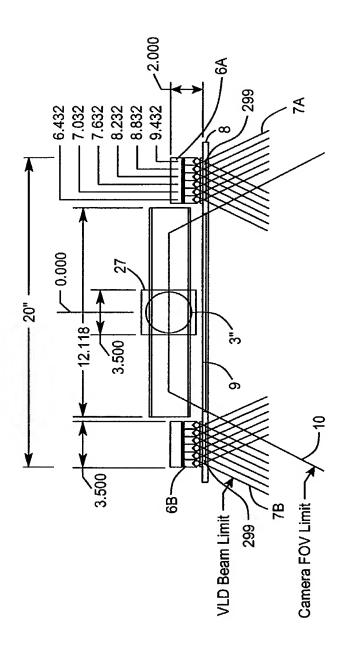


FIG. 3E6

1-1

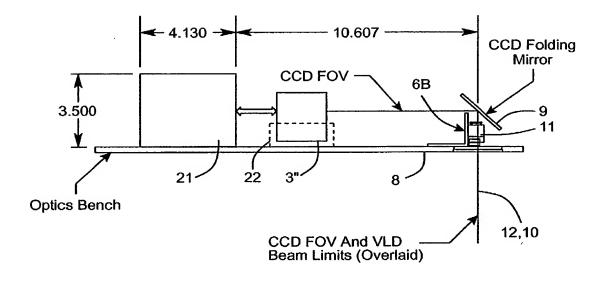


FIG. 3E7

## \* Variable FOV

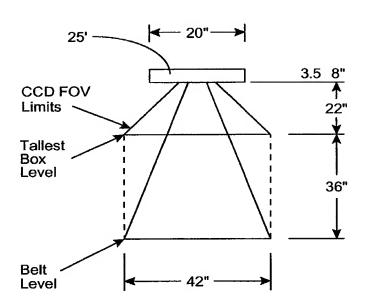


FIG. 3E8

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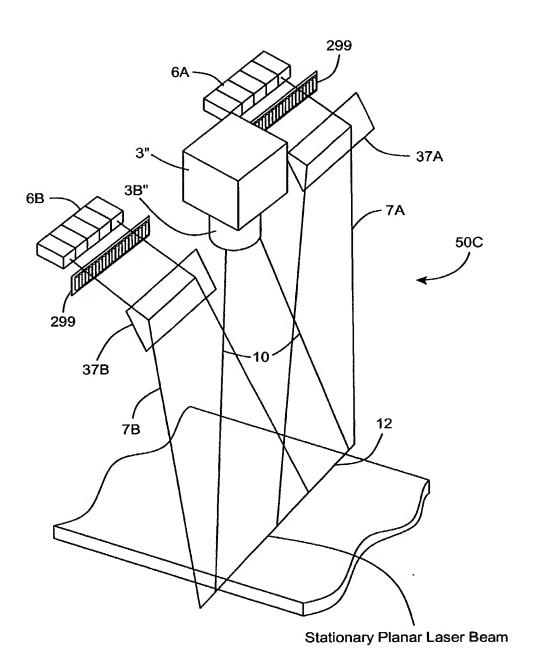
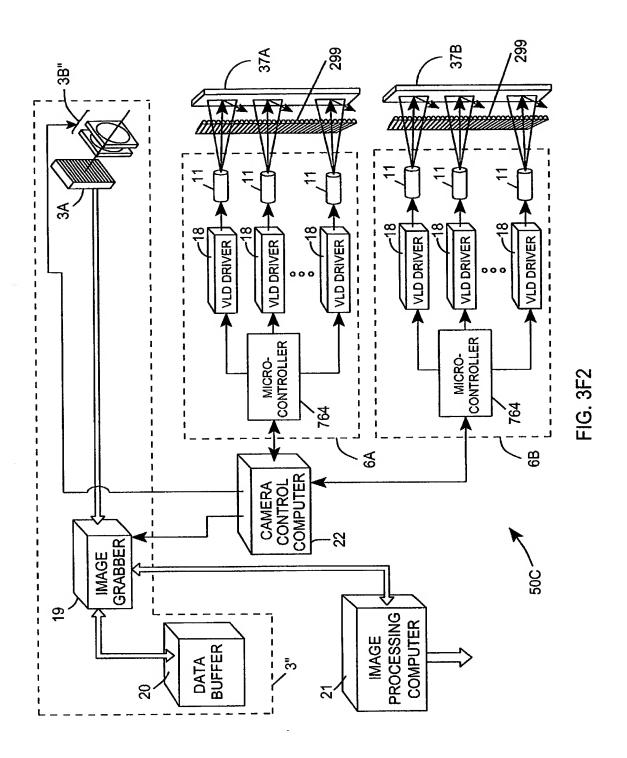


FIG. 3F1





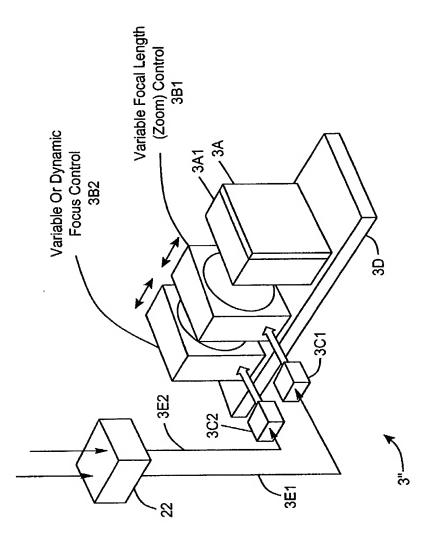


FIG. 3F3

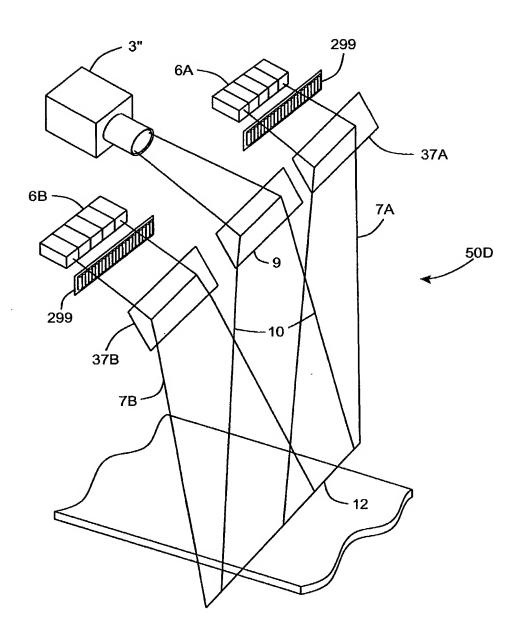


FIG. 3G1

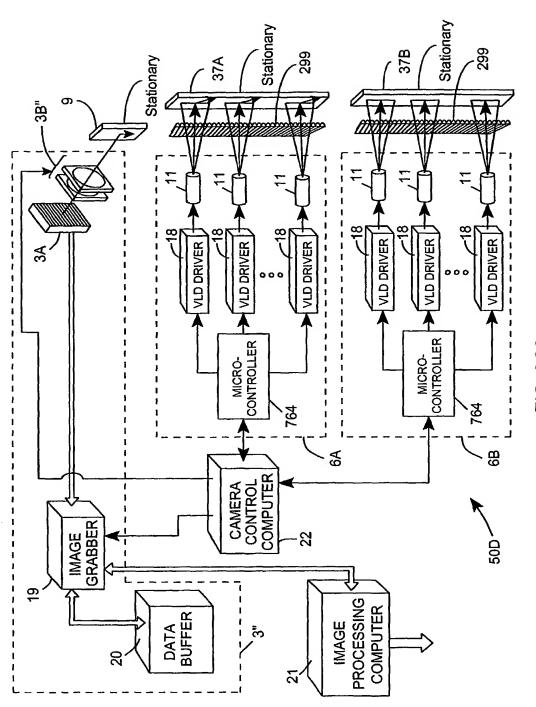


FIG. 3G2

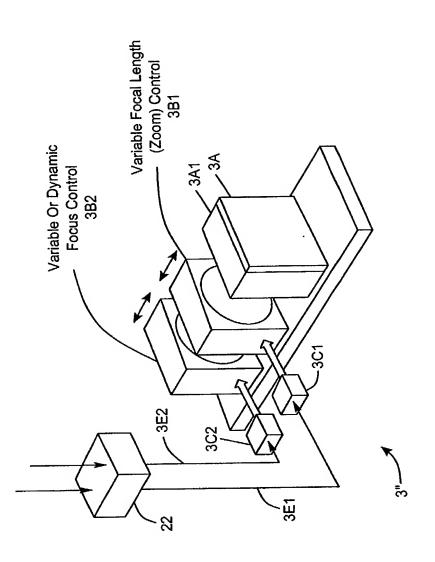


FIG. 3G3

- Variable Focal Length Imaging Lens Variable Focal Distance

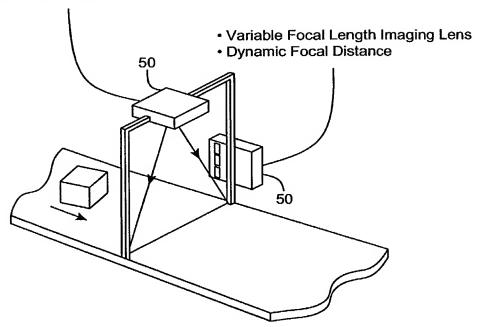
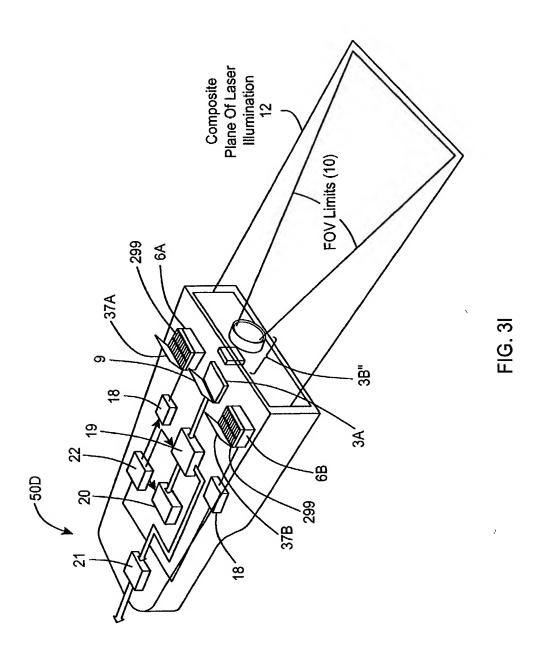


FIG. 3H



And the

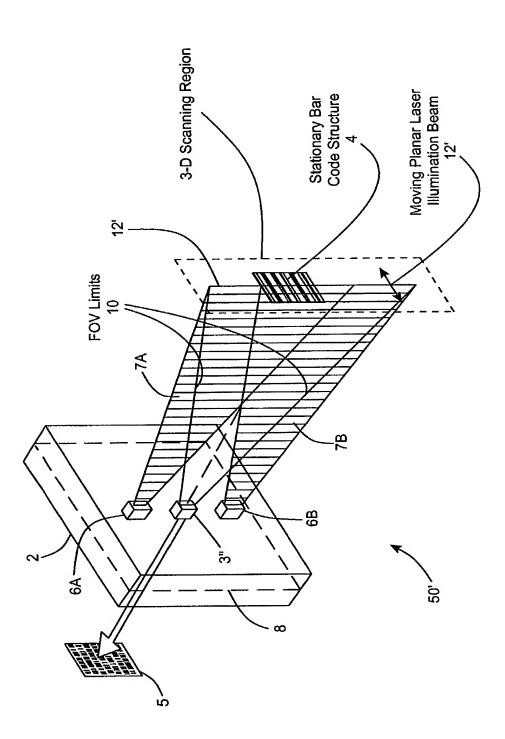


FIG. 3J1

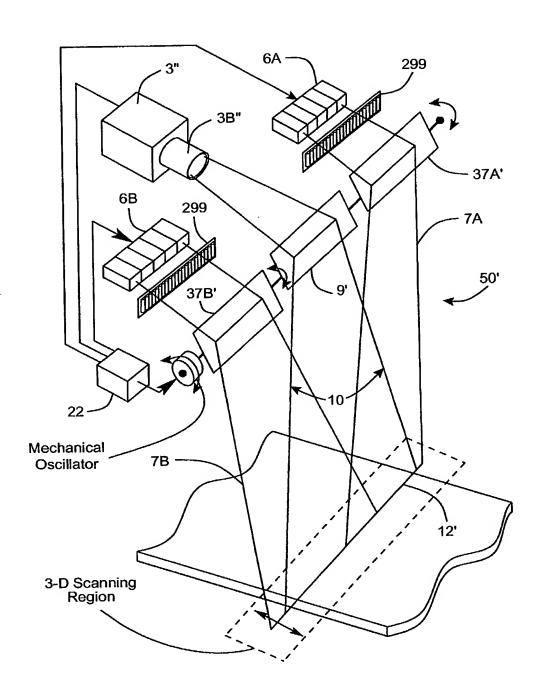
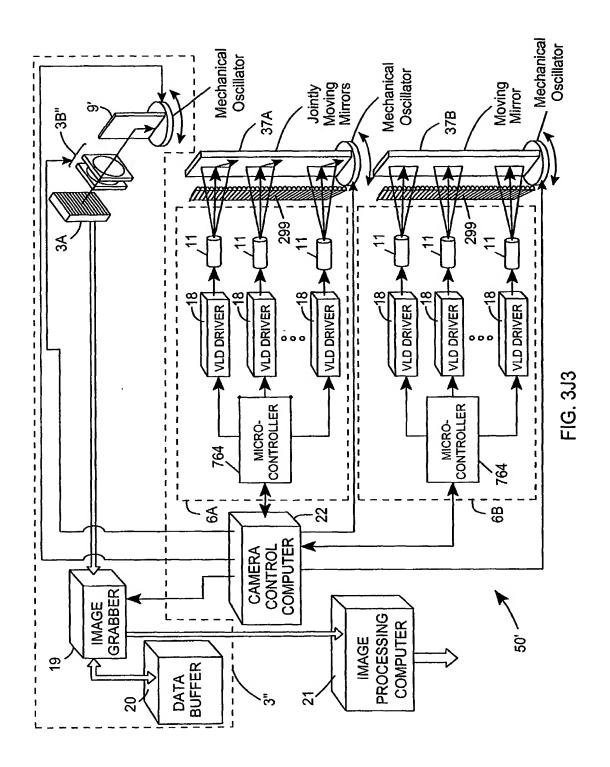


FIG. 3J2



- - 1

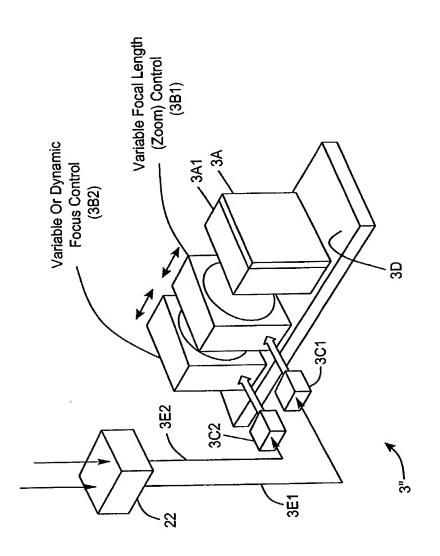


FIG. 3J4

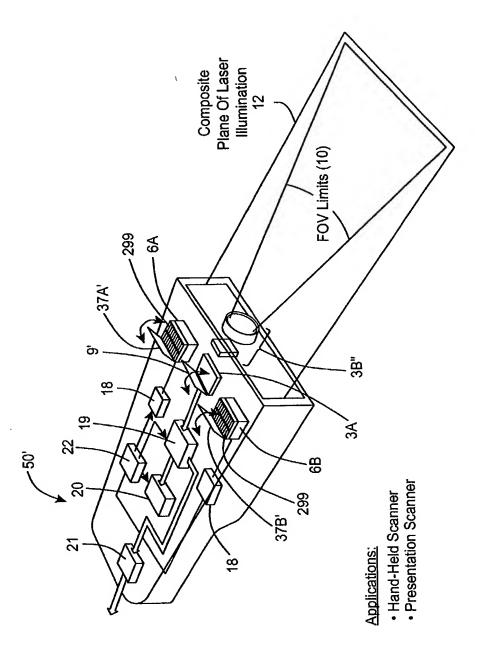
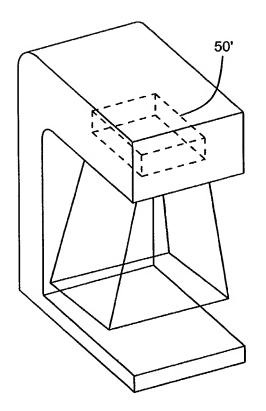
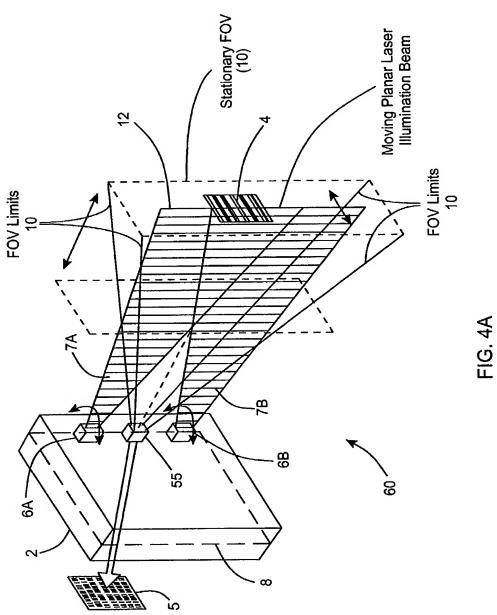


FIG. 3J5



2-D Hold-under Scanner

FIG. 3J6



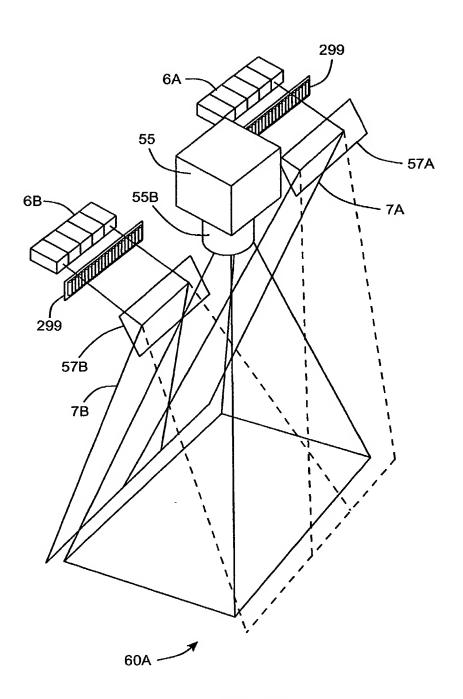


FIG. 4B1

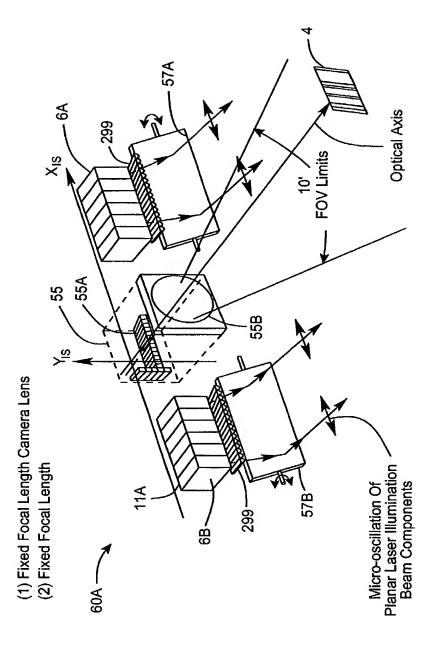
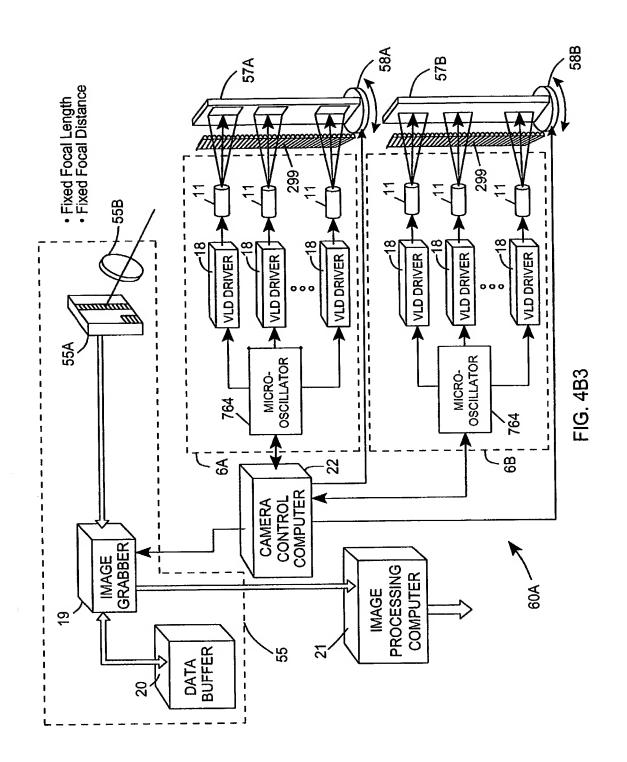


FIG. 4B2



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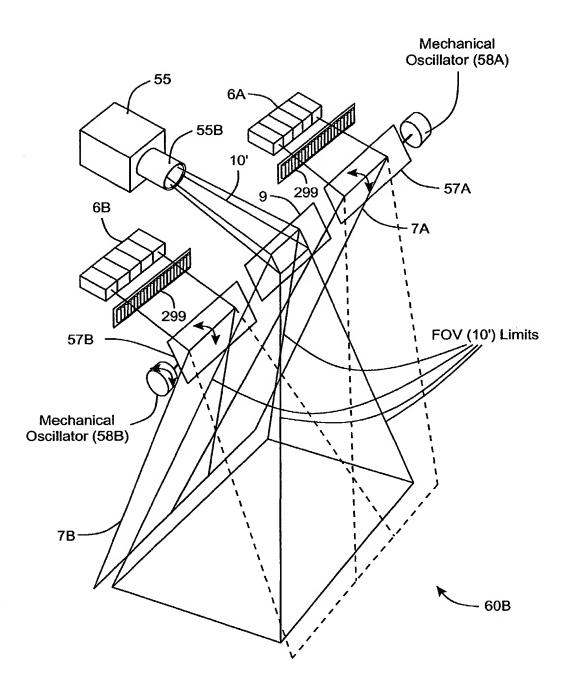
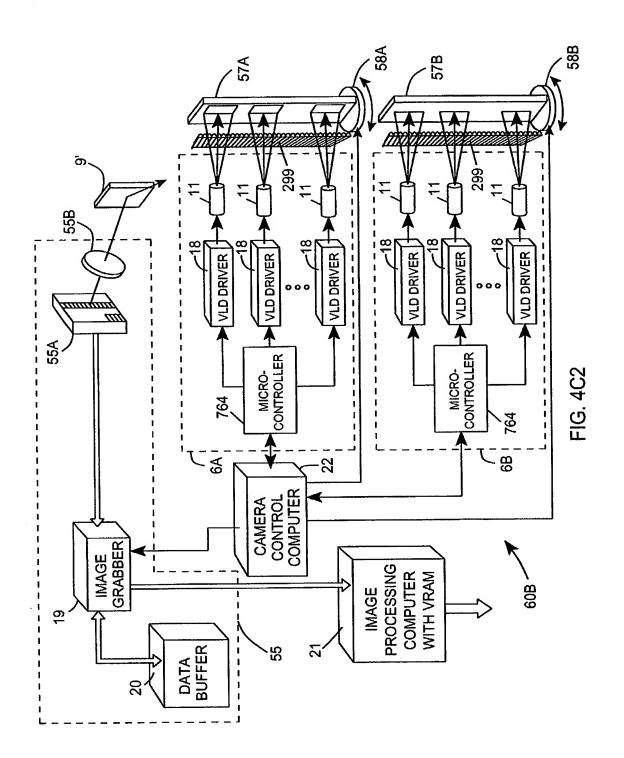
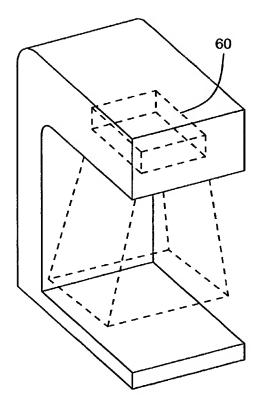


FIG. 4C1

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J. 9

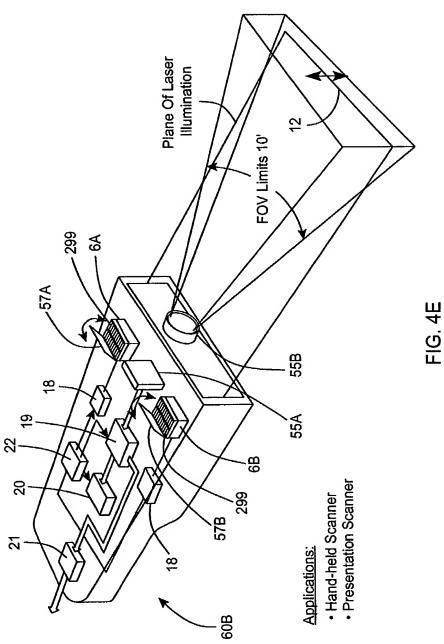




2-D Hold-under Scanner

FIG. 4D





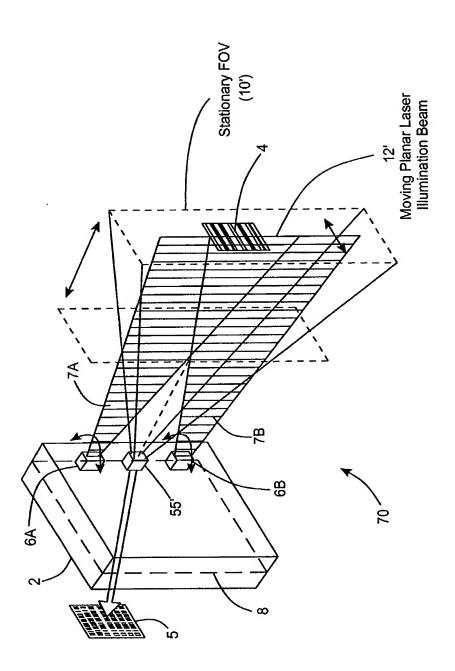


FIG. 5A

. ....

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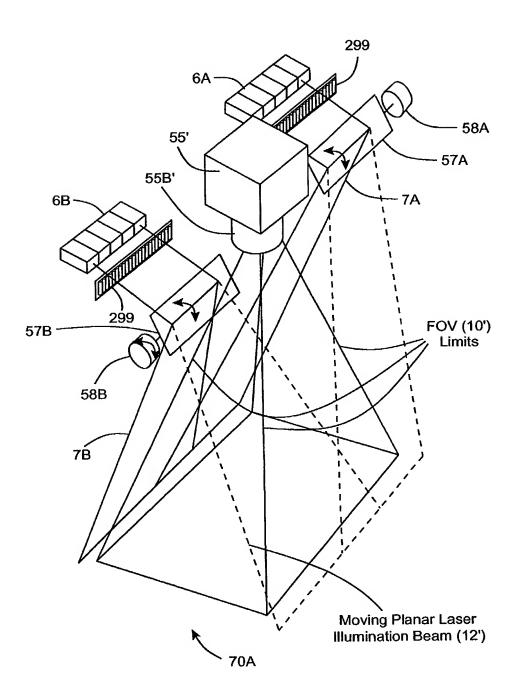


FIG. 5B1

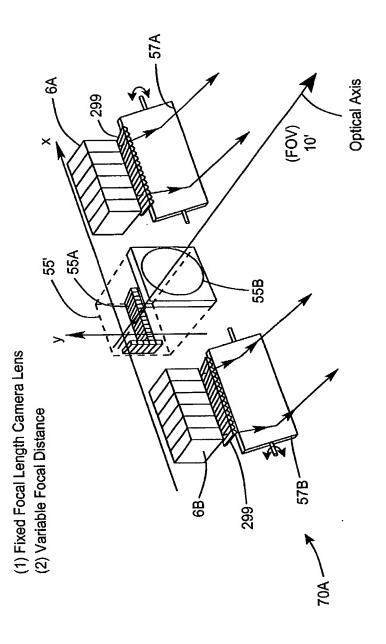
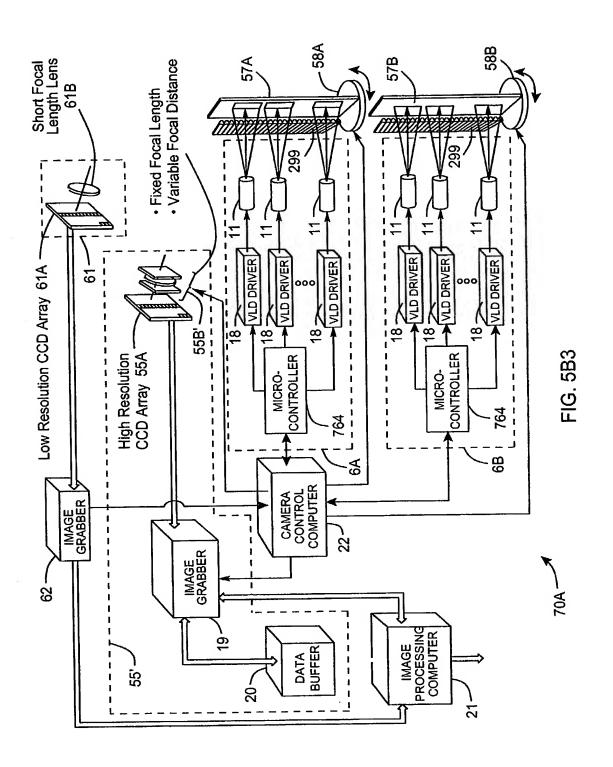


FIG. 5B2



. 4/ 411

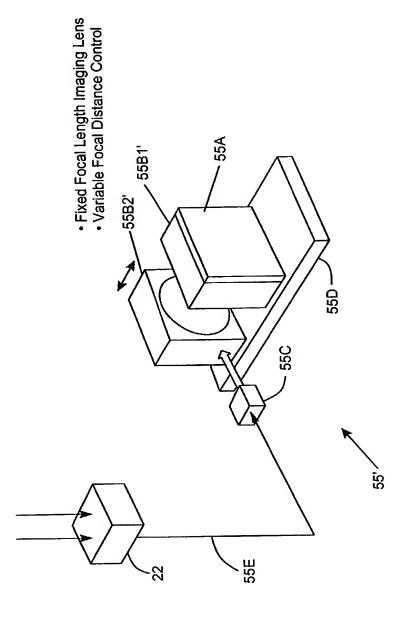


FIG. 5B4

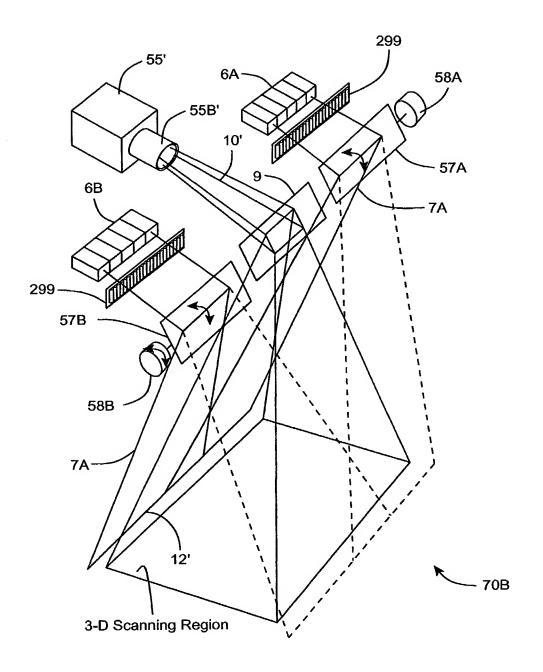


FIG. 5C1

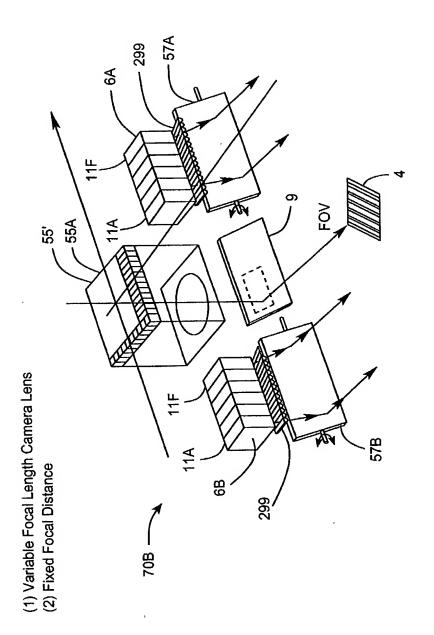
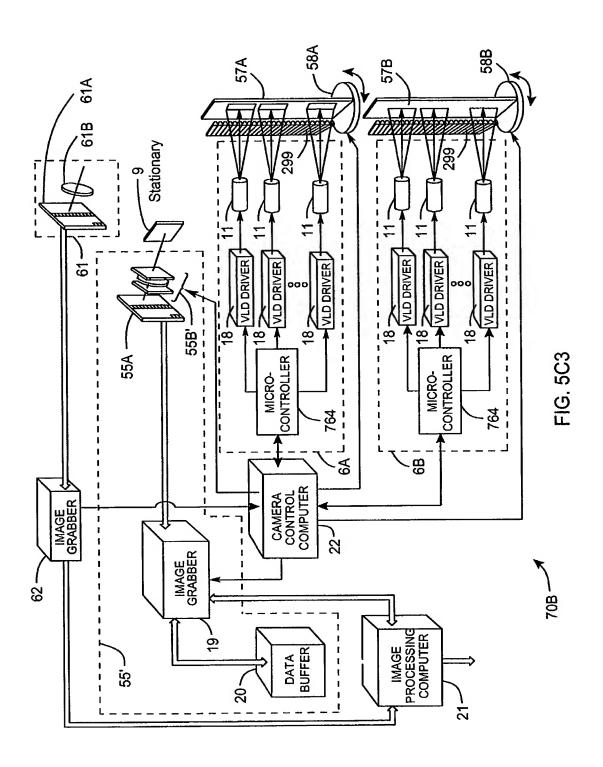
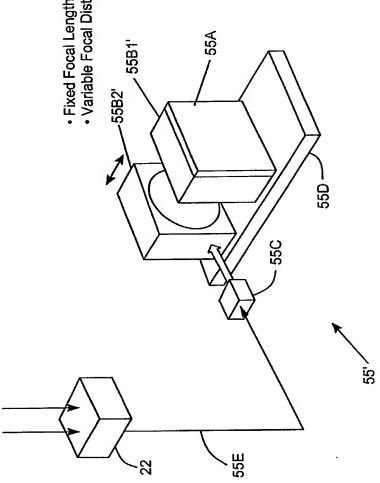


FIG. 5C2



Fixed Focal Length Imaging Lens
 Variable Focal Distance Control





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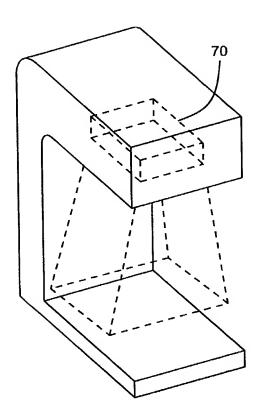


FIG. 5D

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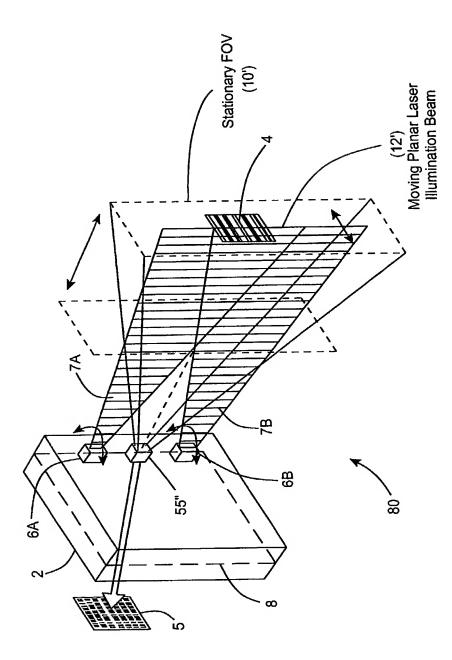


FIG. 6A



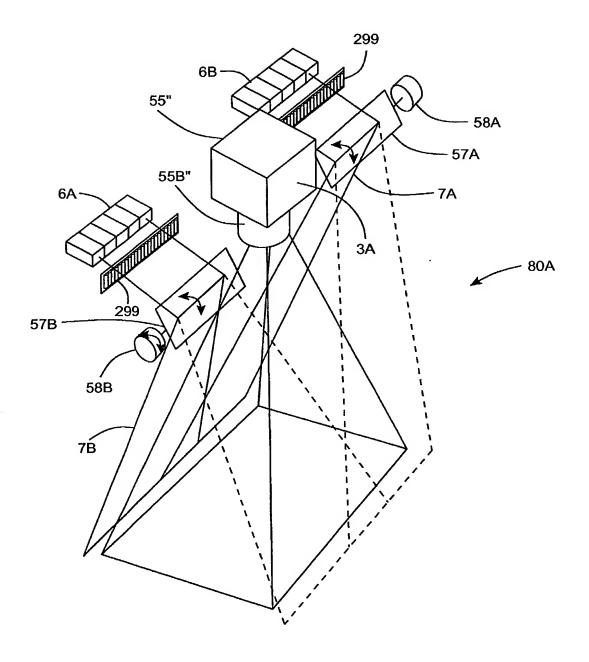


FIG. 6B1

ter ...

. 6A 299 55A , 55" 55B' (1) Variable Focal Length Camera Lens(2) Variable Focal Distance 11A > 57B 68 299~

. 57A

FIG. 6B2

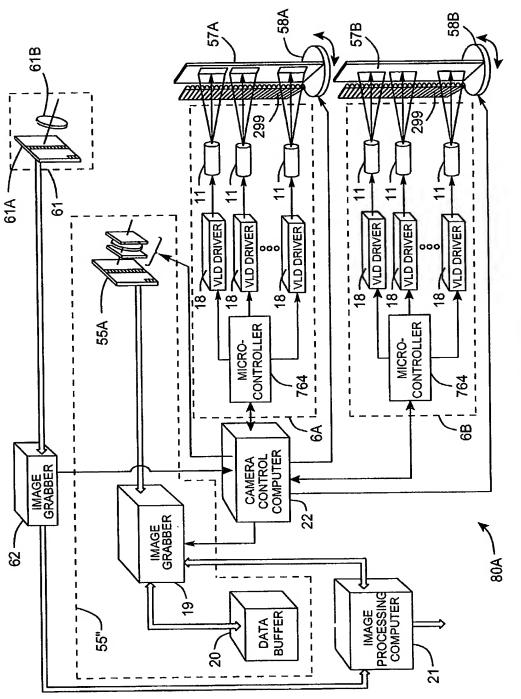


FIG. 6B3

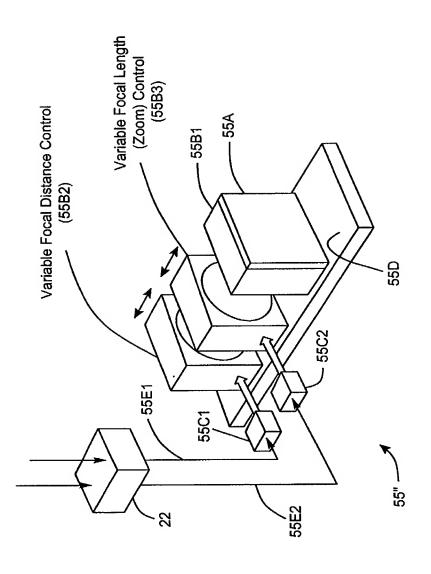


FIG. 6B4

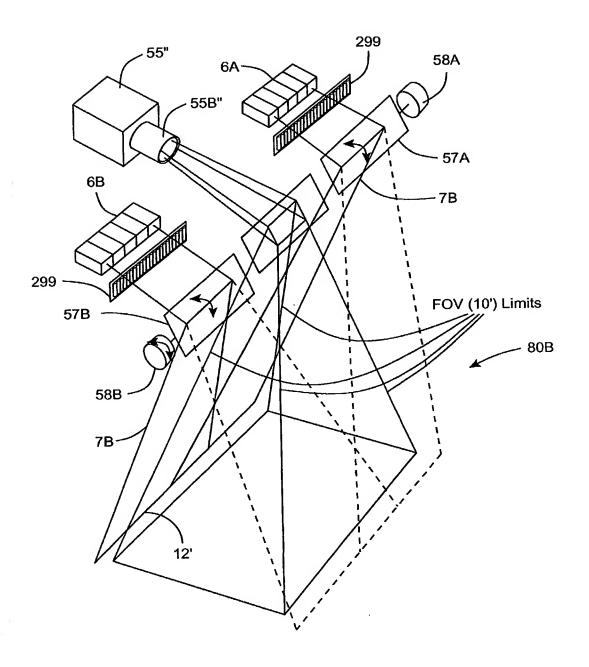


FIG. 6C1

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1001 - - 1

(1) Variable Focal Length Camera Lens(2) Variable Focal Distance

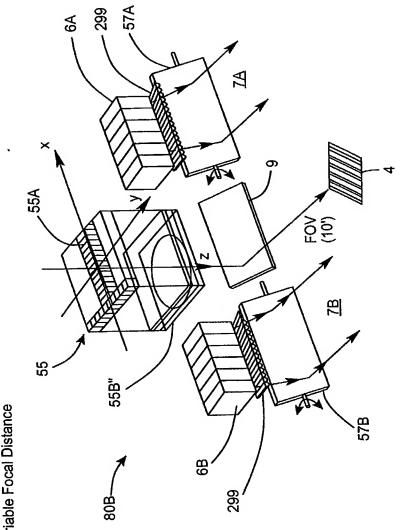
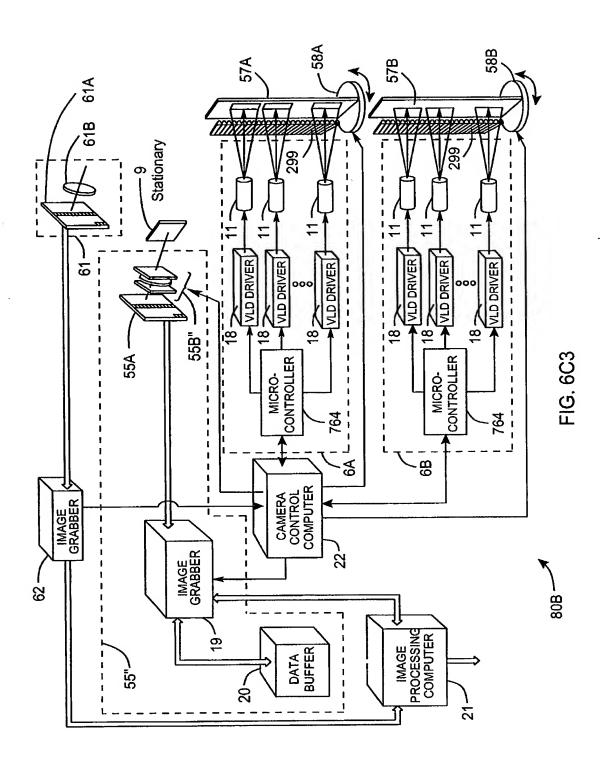


FIG. 6C2



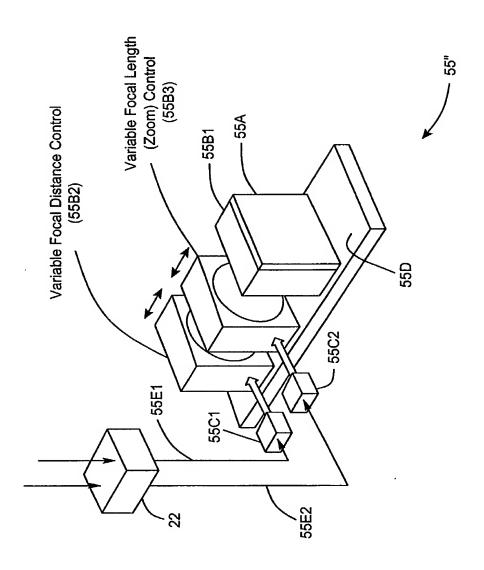


FIG. 6C4

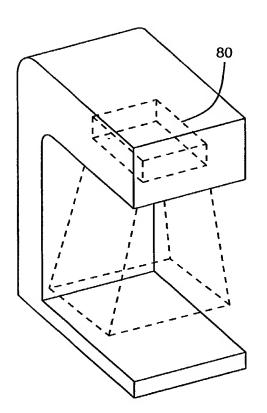


FIG. 6C5

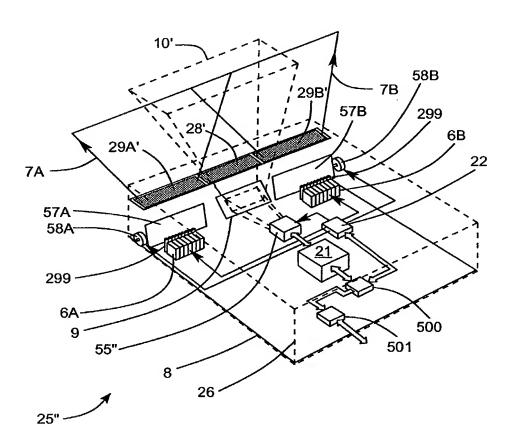


FIG. 6D1

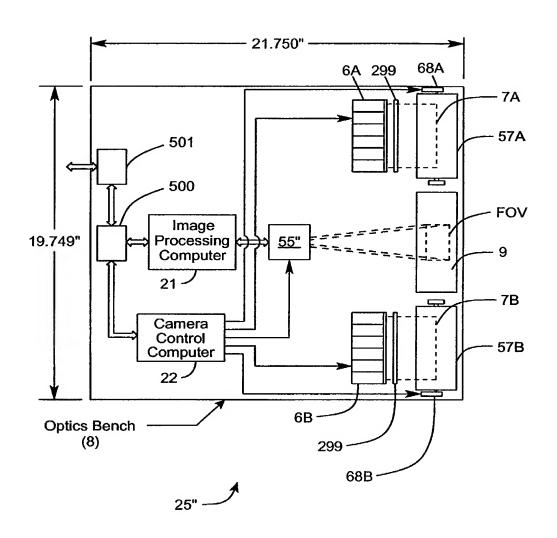


FIG. 6D2

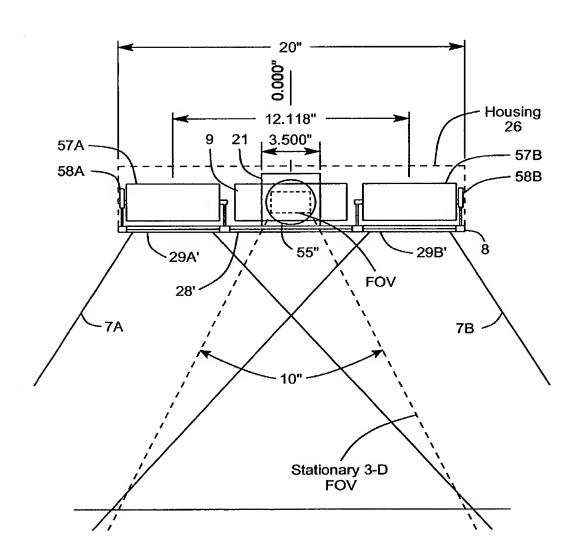


FIG. 6D3

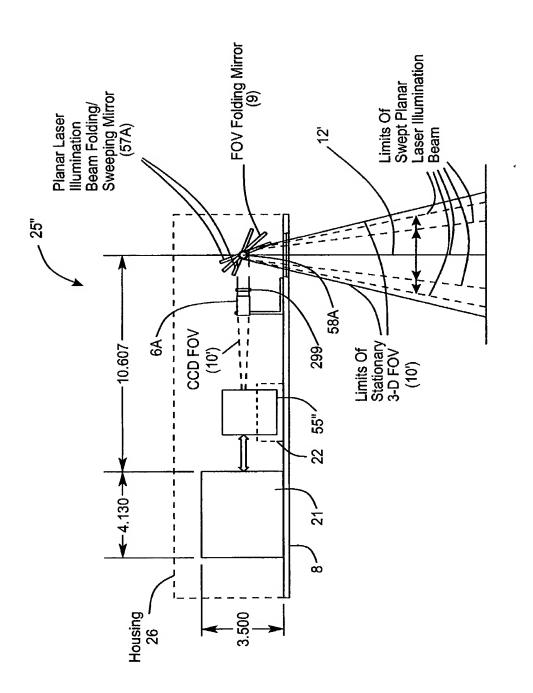


FIG. 6D4

## \* Variable FOV

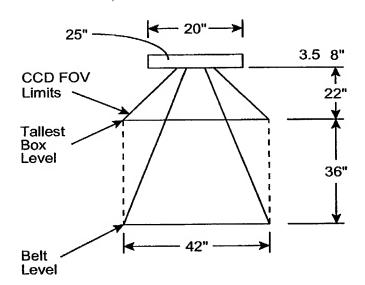


FIG. 6D5

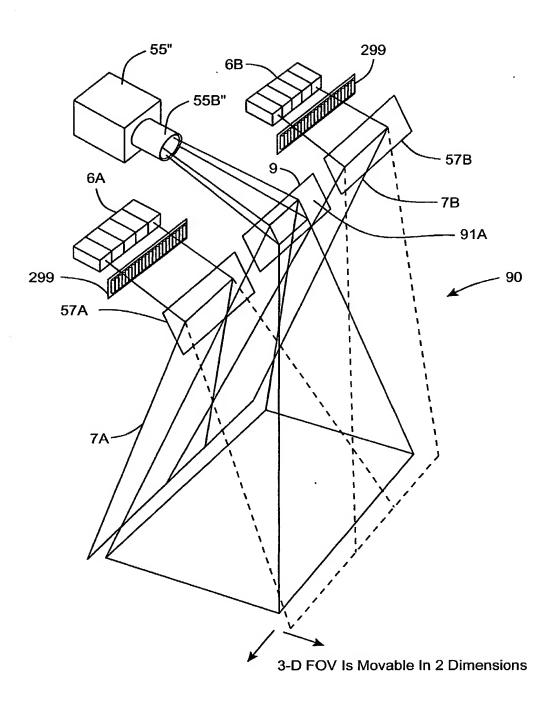
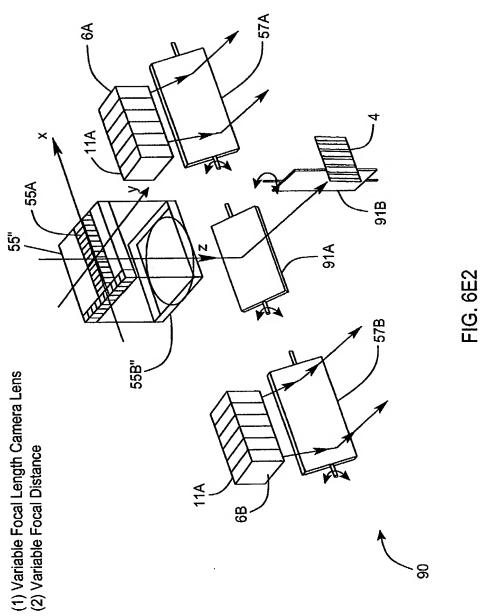
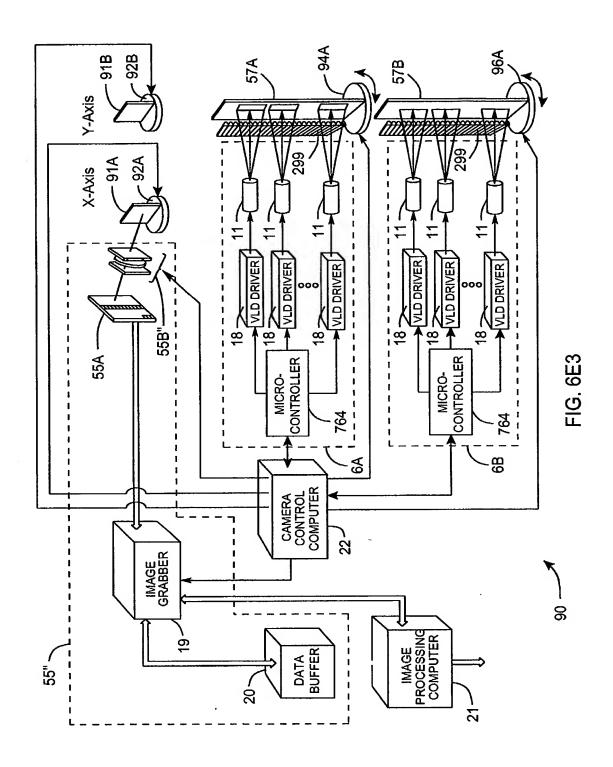


FIG. 6E1





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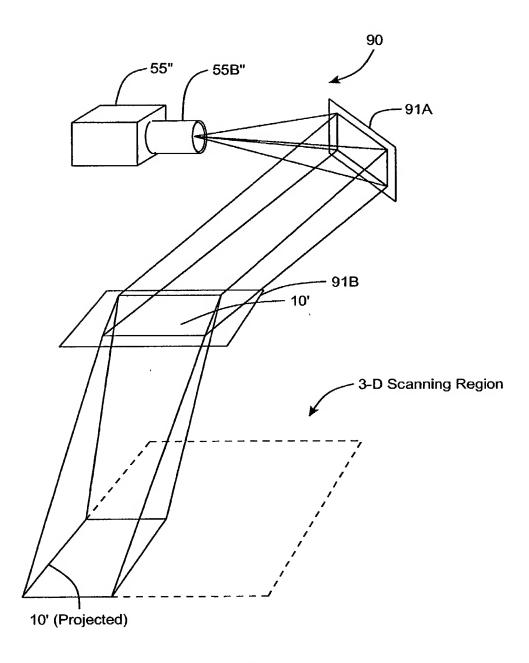


FIG. 6E4

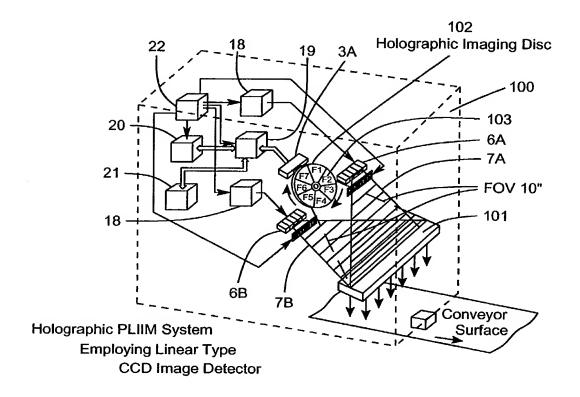


FIG. 7A

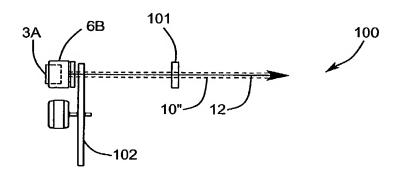


FIG. 7B

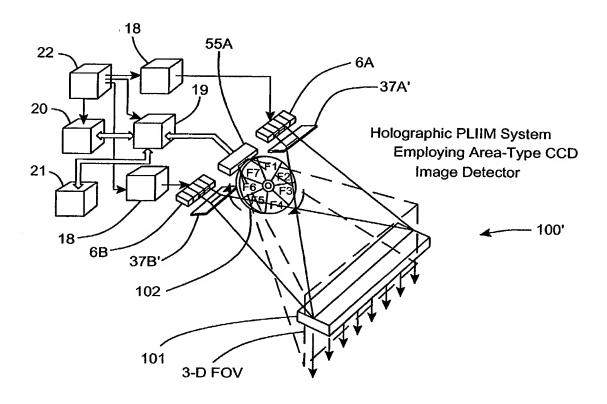


FIG. 8A

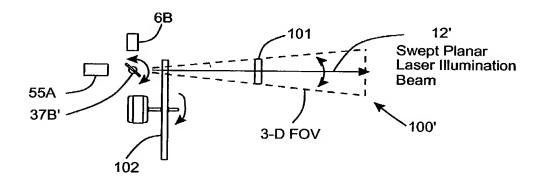


FIG. 8B

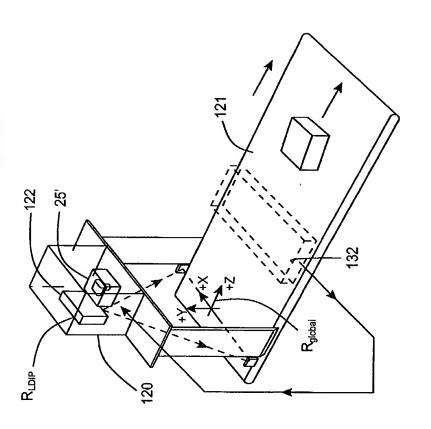
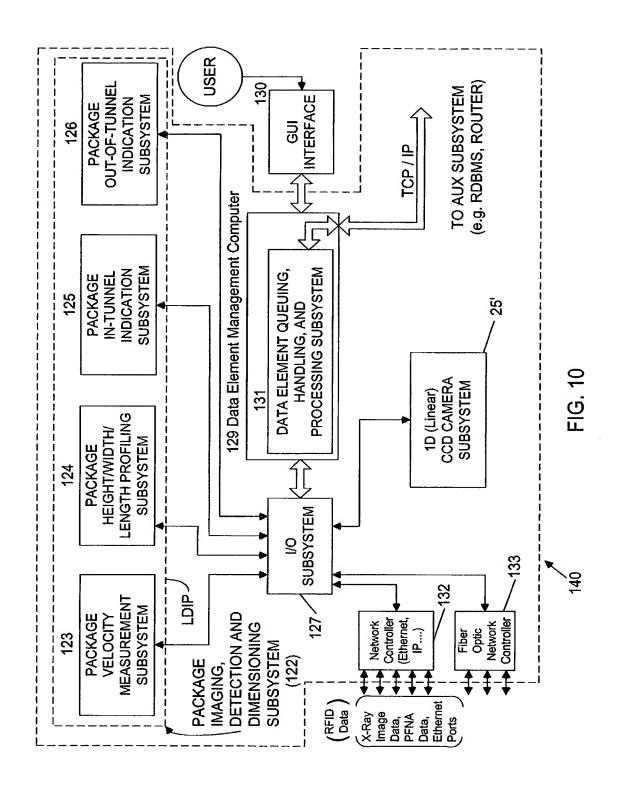
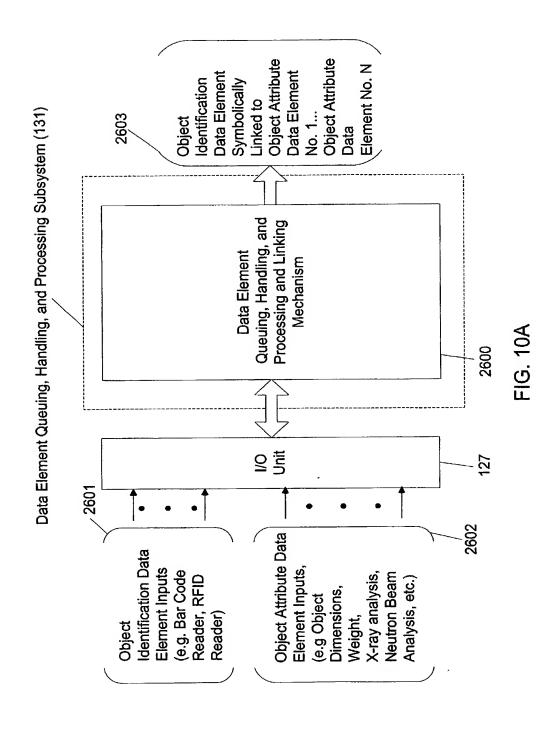
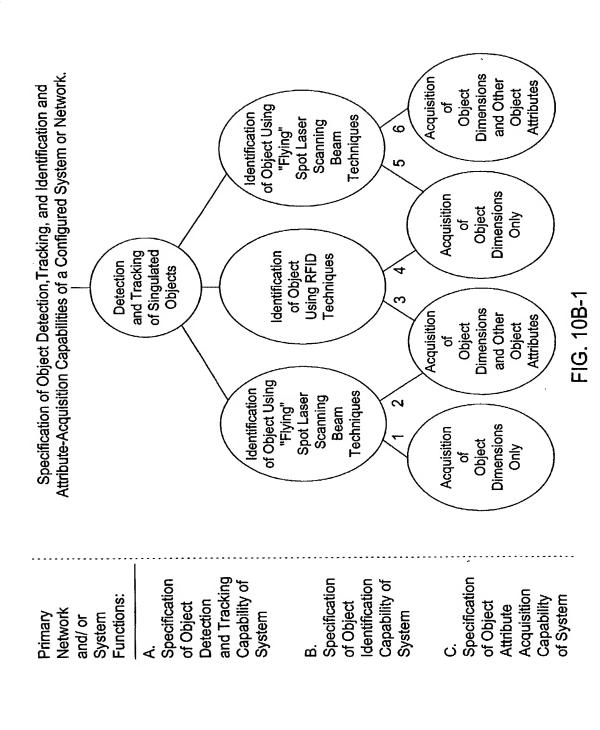
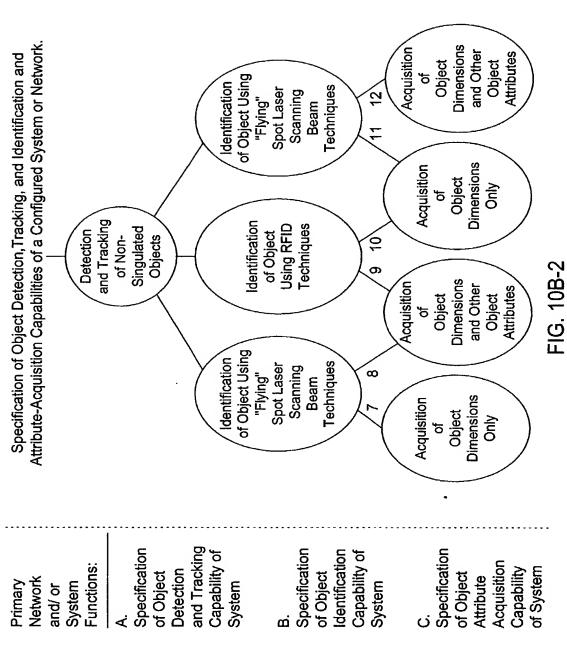


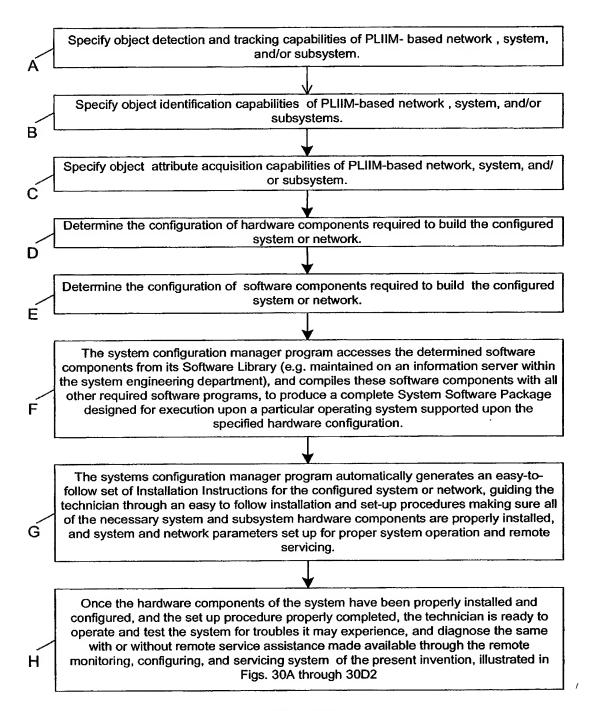
FIG. 9











**FIG. 10C** 

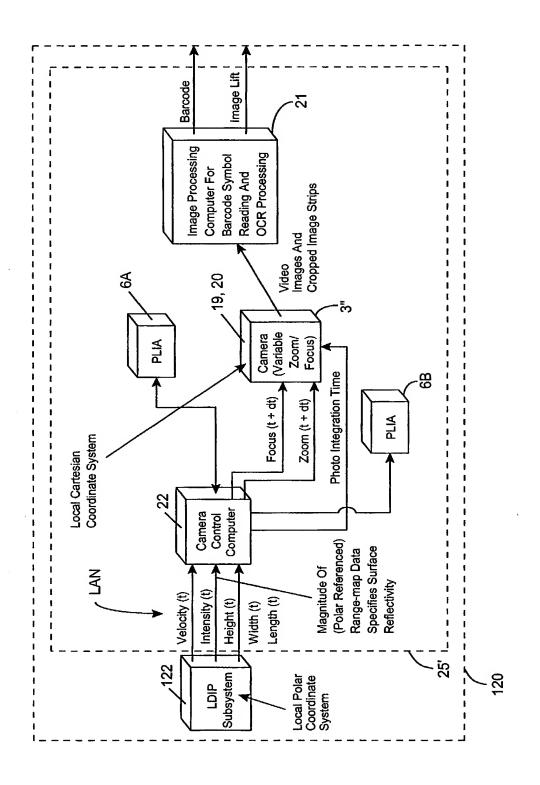


FIG. 1

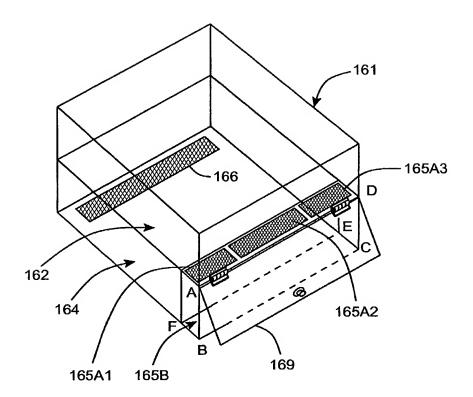


FIG. 12A

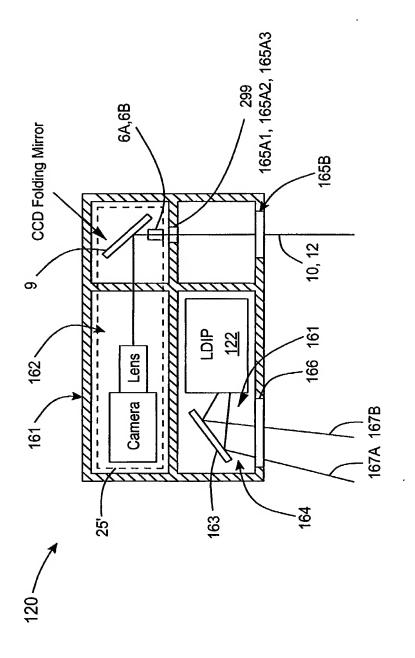


FIG. 12E

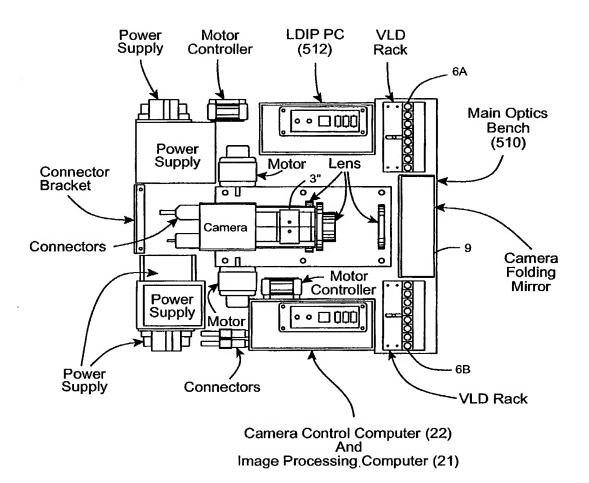


FIG. 12C

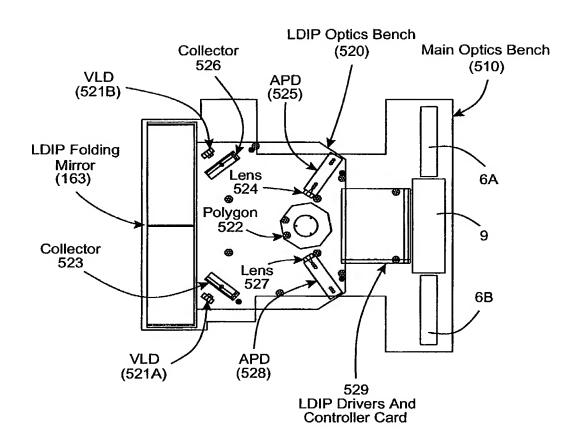
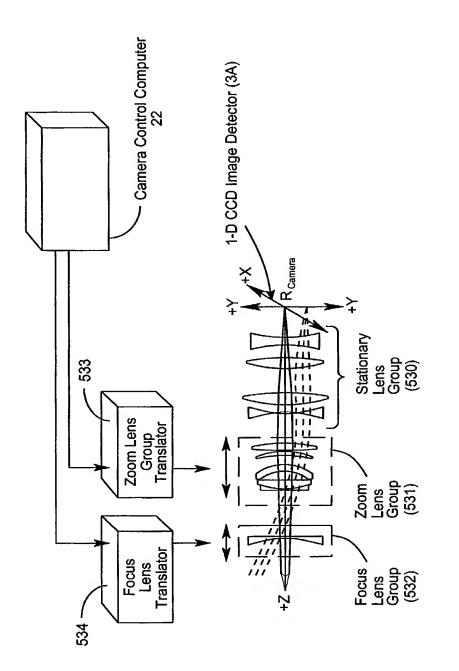


FIG. 12D



Main Optics Lens Groups

FIG. 12E

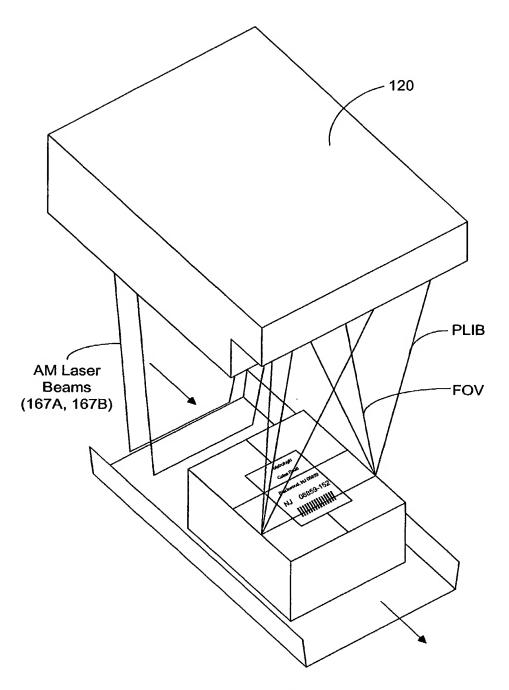


FIG. 13A

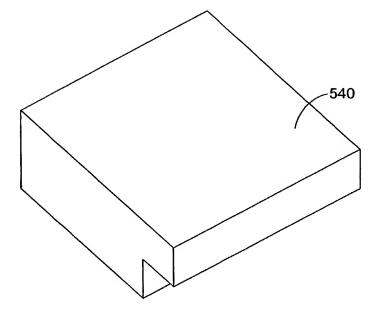


FIG. 13B

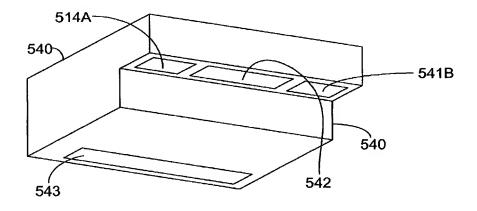


FIG. 13C

## PLIIM-BASED PACKAGE IDENTIFICATION AND DIMENSIONING (PID) SYSTEM

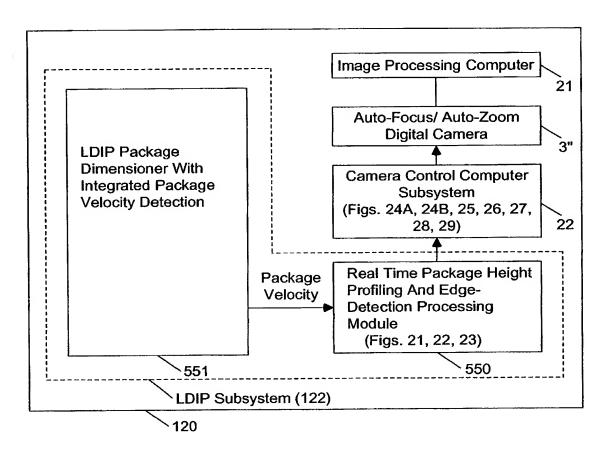


FIG. 14

### LDIP REAL-TIME PACKAGE HEIGHT PROFILE AND EDGE DETECTION METHOD

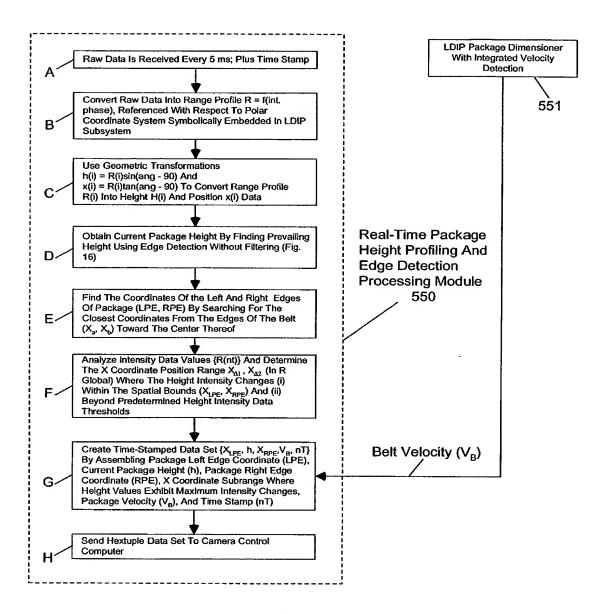


FIG. 15

#### LDIP REAL-TIME PACKAGE EDGE DETECTION

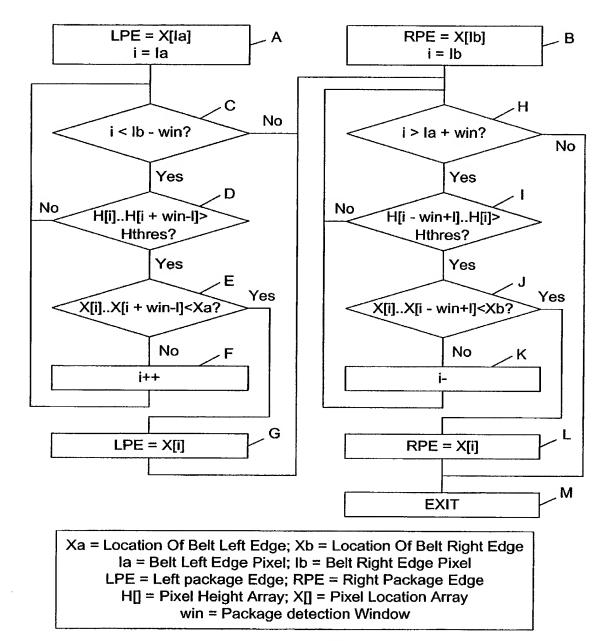


FIG. 16

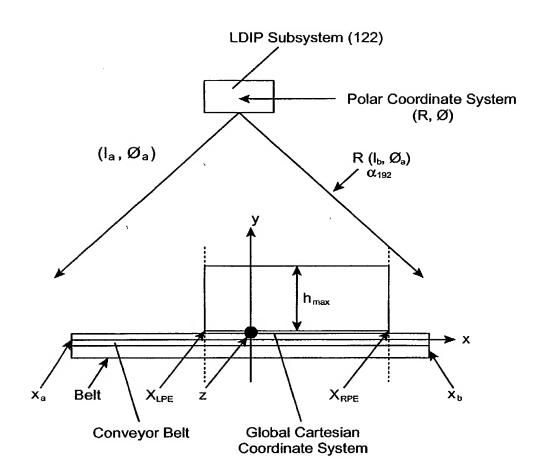


FIG. 17

### Information Measured At Scan Angles Before Coordinate Transformations

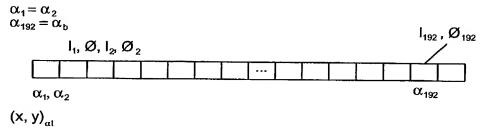


FIG. 17A

## Range And Polar Angle Measures Taken At Scan Angle $\alpha$ Before Coordinate Transforms

Range And Polar

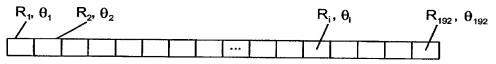
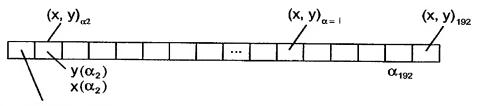


FIG. 17B

### Measured Package Height And Position Values After Coordinate Transforms

H [ ] Input Height After Coordinate Transforms



Height Value  $y(\alpha_1)$  And Position Value  $x(\alpha_1)$  Measured At Left Belt Edge

FIG. 17C

# CAMERA CONTROL PROCESS CARRIED OUT WITHIN THE CAMERA CONTROL SUBSYSTEM OF EACH OBJECT IDENTIFICATION AND ATTRIBUTE ACQUISITION SYSTEM OF PRESENT INVENTION

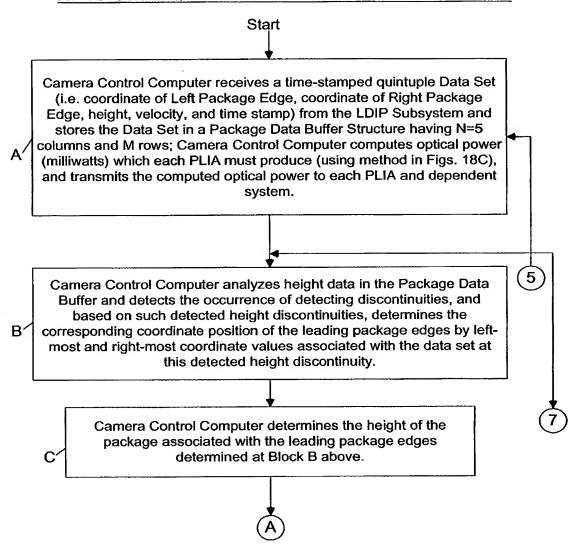


FIG. 18A-1

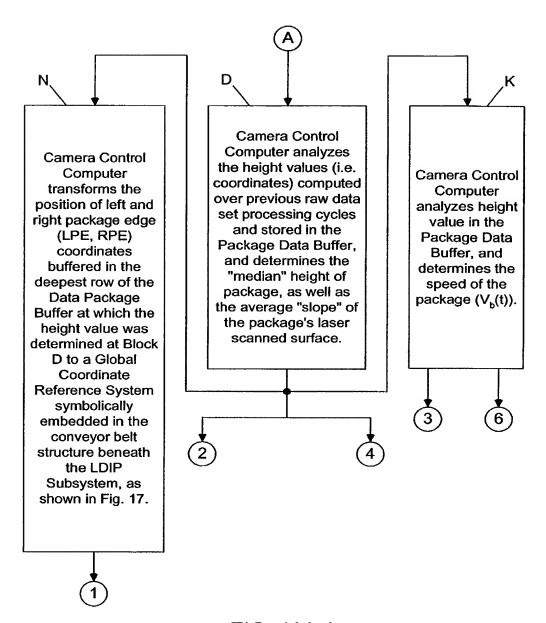
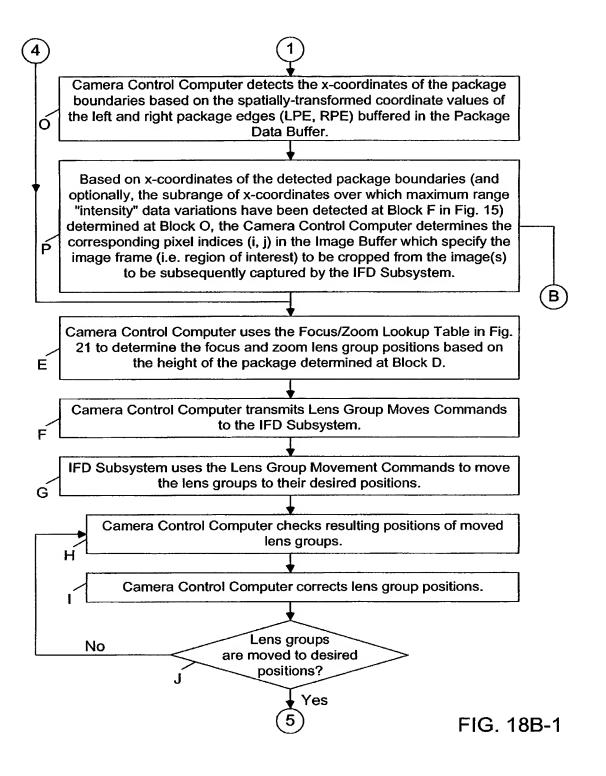


FIG. 18A-2



Camera Control Computer uses the computed values of median package height, belt speed and the Photo-Integration Time Lookup Table in Fig. 23 to determine the photo-integration time parameter which will ensure that "square" image pixels are produced in captured package images (i.e. pixels having a 1:1 ratio); Camera Control Computer also uses (i) computed belt speed/velocity, (ii) the prespecified image resolution (dpi), and (iii) computed "slope" of laser scanned surface so as to compute the surface-slope compensated Line Rate of the IFD subsystem that helps ensure that captured linear images have substantially constant pixel resolution (dpi) independent of the angular arrangement of the package surface during surface profiling and imaging operations. M Camera Control Computer generates digital control signals for the compute parameters--Photo-Integration Time Period and Compensated Line Rate-- and thereafter transmits these digital control signals to the CCD image detection array in the IFD Subsystem. Camera Control Computer uses package time-stamp (nT) and package velocity (V) to determine the "Start Time" of Image Frame Capture (STIC) ∙R Camera Control Computer uses (i) the Start Time of Image Capture (STIC) determined at Block Q, to generate a command for starting Image Frame Capture, and also uses (ii) the pixel indices (i,j) determined at Block P to generate commands for cropping the corresponding slice of the "region of interest" in the image being captured and buffered in the Image Buffer within the IFD Subsystem. Camera Control Computer transmits the command generated at Block R to the IFD Subsystem. FIG. 18B-2

# METHOD OF COMPUTING OPTICAL OUTPUT POWER FROM LASER DIODES IN A PLANAR LASER ILUMINATION ARRAY (PLIA) FOR CONTROLLING THE CONSTANT WHITE-LEVEL IN IMAGE PIXELS CAPTURED BY A PLIIM-BASED LINEAR IMAGER

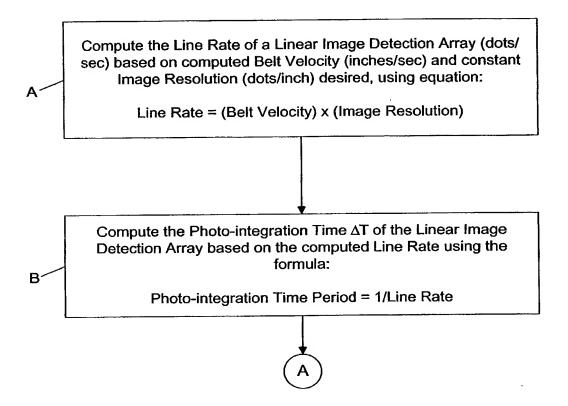
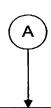


FIG. 18C1

-- 1/517



Compute the Optical Power (milliwatts) of each PLIA based on the computed Photo-integration Time Period (ΔT) using the following formula:

Optical Power of VLD (milliwatts) = constant

Photo-integration Time Period ΔT

FIG. 18C2

# METHOD OF COMPUTING COMPENSATED LINE RATE FOR CORRECTING VIEWING-ANGLE DISTORTION OCCURING IN IMAGES OF OBJECT SURFACES CAPTURED AS OBJECT SURFACES MOVE PAST A PLIIMBASED LINEAR IMAGER AT NON-ZERO SKEWED ANGLE

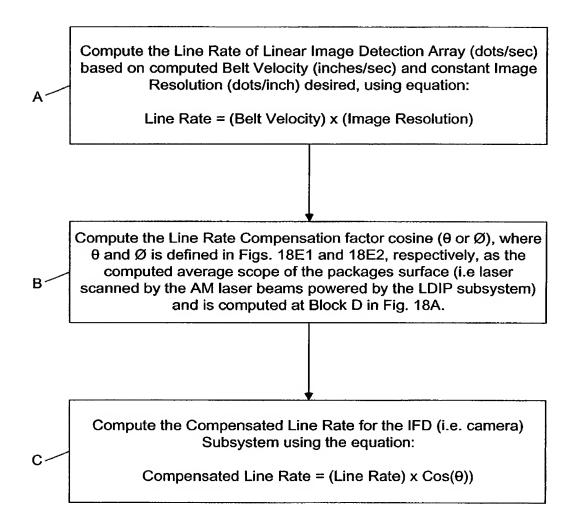


FIG. 18D

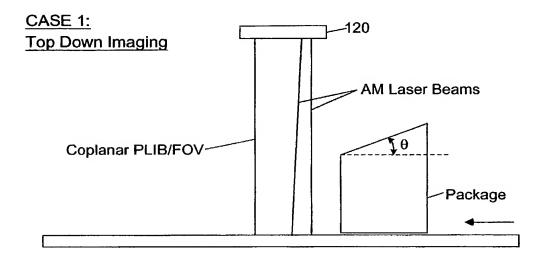


FIG. 18E1

### CASE 2: Side Imaging

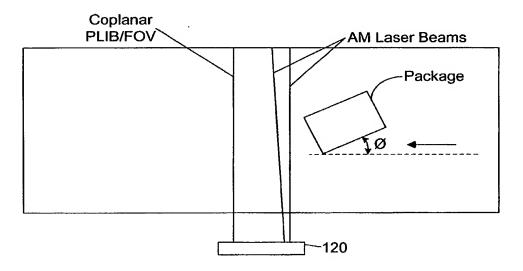


FIG. 18E2

### X Coordinate Subrange Where Maximum Range "Intensity" Variations Have Been Detected

Left Package Edge (LPE)	Package Height (h)	Right Package Edge (RPE)	Package Velocity	Time- Stamp (nT)	
					Row 1
					Row 2
					Row 3
				···	Row 4
				· <del>7 · · · · · · · · · · · · · · · · · · </del>	Row 5
		1			Row M

Package Data Buffer (FIFO)

FIG. 19

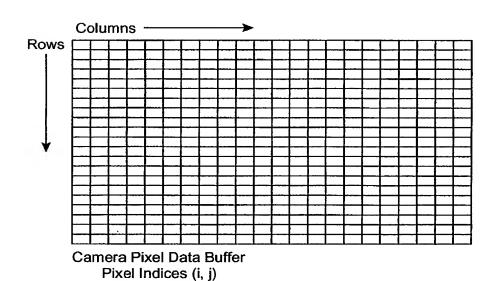


FIG. 20

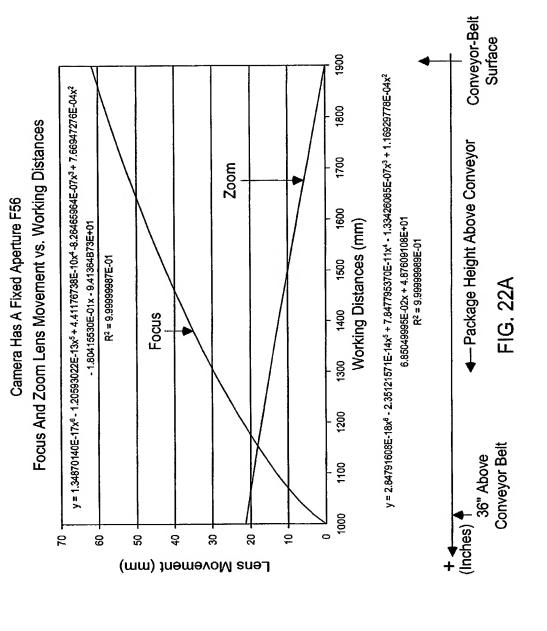
Zoom And Focus Lens Group Position Look-Up Table

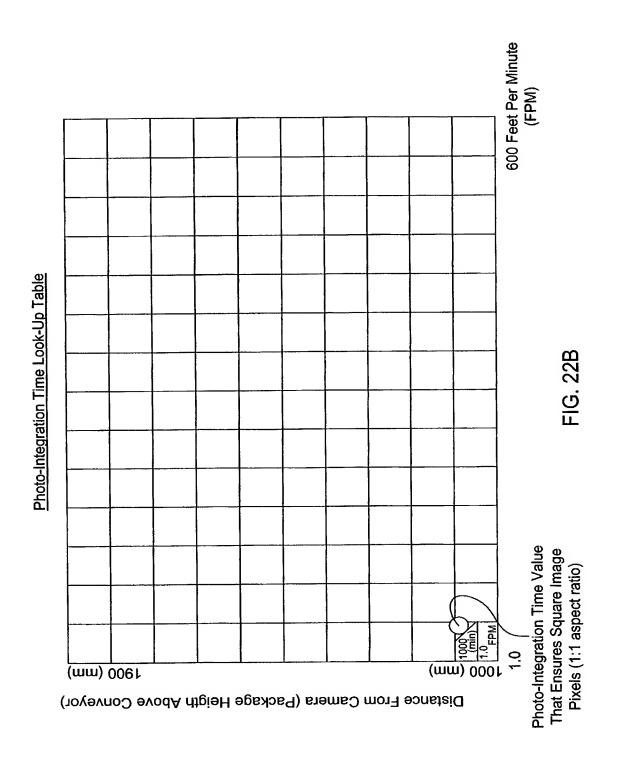
Focus Group Distance (mm) Y (Focus)	2.47E-05 10.99009783 20.65783177 29.10917002 36.47312595 42.87845436 48.44003358 53.25495831 57.40834303 60.98883615
Zoom Group Distance (mm) Y (Zoom)	21.57489228 19.38089696 17.10673434 14.77137314 12.39153565 9.979114358 7.540639114 5.078794775 2.595989366 0.099972739
Distance From Camera H (mm)	1000 1100 1200 (Use Interpolation 1300 Techniques For 1500 Working Distances 1600 Between Listed 1700 Points In Table) 1900

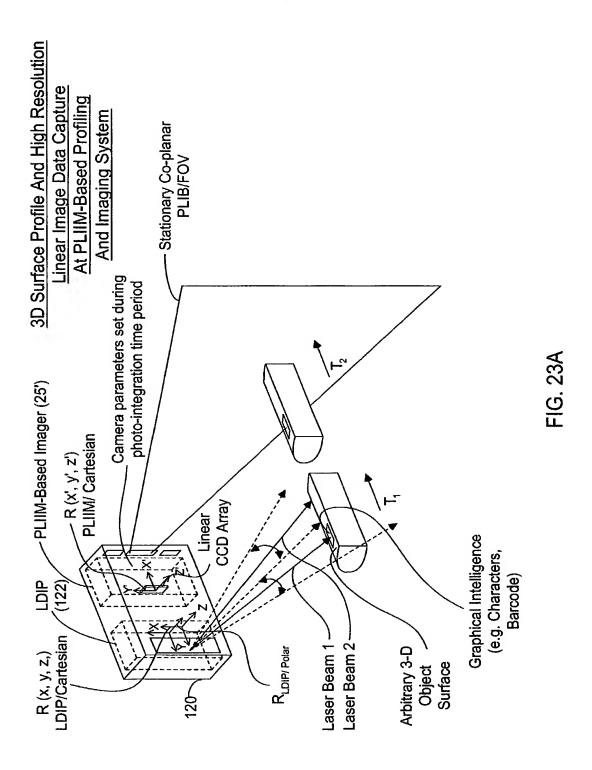
FIG. 2

\* Note: The focal distance and zoom (eff. focal length) of camera lens are coupled

(inter-dependant) in this commercial embodiment.







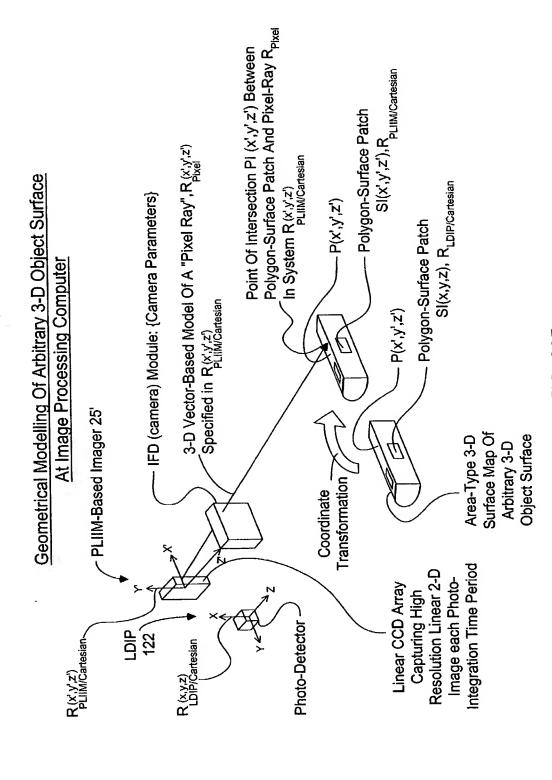


FIG. 23B

# METHOD OF AND APPARATUS FOR PERFORMING AUTOMATIC RECOGNITION OF GRAPHICAL INTELLIGENCE CONTAINED IN 2-D IMAGES CAPTURED FROM ARBITARY 3-D OBJECT SURFACES

STEP 1: At the unitary PLIIM-based object imaging and profiling system, use the laser doppler imaging and profiling (LDIP) subsystem employed therein to (i) consecutively capture a series of linear 3-D surface profile maps on a targeted arbitrary (e.g. non-planar or planar) 3-D object surface bearing forms of graphical intelligence and (ii) measure the velocity of the arbitrary 3-D object surface, wherein the polar coordinates of each point in the captured linear 3-D surface profile map are specified in a local polar coordinate system R<sub>LDIP/polar</sub>, symbolically embedded within the LDIP subsystem.

STEP 2: At the unitary PLIIM-based object imaging and profiling system, use coordinate transforms to automatically convert the polar coordinates of each point  $p(\alpha, R)$  in the captured linear 3-D surface profile map into x,y, z Cartesian coordinates specified as p(x,y,z) in a local Cartesian coordinate system  $R_{LDIP/Cartesian}$ , symbolically embedded within the LDIP subsystem.

STEP 3: At the unitary PLIIM-based object imaging and profiling system, use the PLIIM-based imager employed therein to consecutively capture high-resolution linear 2-D images of the arbitrary 3-D object surface bearing forms of graphical intelligence (e.g. symbol character strings), wherein (i) the x', y' coordinates of each pixel in each said captured high-resolution linear 2-D image is specified in local Cartesian coordinate system R<sub>PLIIM/Cartesian</sub> symbolically embedded within the PLIIM-based imager, and (ii) the intensity value of the pixel I(x',y') is associated with the x', y' Cartesian coordinates of the image detection element in the linear image detection array at which the pixel is detected, and (iii) wherein also the planar laser illumination beam (PLIB) of the PLIIM-based imager is spaced from the amplitude modulated (AM) laser scanning beam of the LDIP subsystem is about D centimeters.

FIG. 23C1

·B

(A)

STEP 4: At the unitary PLIIM-based object imaging and profiling system, capture and buffer the camera (IFD) parameters used to form and detect each linear high-resolution 2-D image captured during the corresponding photo-integration time period  $\Delta T_{\rm K}$ , by the PLIIM-based imager.

STEP 5: At the end of each photo-integration time period  $\Delta T_{K}$ , use the unitary PLIIM-based object imaging and profiling system to transmit the following information elements to the Image Processing Computer for data storage and subsequent information processing:

(1) the converted coordinates x, y, z, of each point in the linear 3-D surface profile map of the arbitrary 3-D object surface captured during photo-integration time period  $\Delta T_{\rm K}$ ;

(2) the measured velocity(ies) of the arbitrary 3-D object surface during photo-integration time period  $\Delta T_{\kappa}$ ;

(3) the x', y' coordinates and intensity value I(x',y') of each pixel in each high- resolution linear 2-D image captured during photo-integration time period DTk and specified in the local Cartesian coordinate system R<sub>PLIIM/Cartesian</sub>; and

(4) the captured camera (IFD) parameters used to form and detect each linear high-resolution 2-D image captured during the photo-integration time period  $\Delta T_{\rm K}$ 

STEP 6: At the Image Processing Computer, receive the data elements transmitted from the PLIIM-based profiling and imaging system durin Step 5, buffer data elements (1) and (2) in a first FIFO buffer memory structure, and data elements (3) and (4) in a second FIFO buffer memory structure.

FIG. 23C2

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STEP 7: At the Image Processing Computer, use the x,y, z coordinates associated with a consecutively captured series of linear 3-D surface profile maps (i.e. stored in first FIFO memory storage structure)in order to construct a 3-D polygon-mesh surface representation of said arbitrary 3-D object surface, represented by S<sub>LDIP</sub> (x,y,z) and having (i) vertices specified by x,y, z in local coordinate reference system R<sub>PLIIM/Cartesian</sub>, and (ii) planar polygon surface patches s (x,y,z) and being defined by a set of said vertices.

STEP 8: At the Image Processing Computer, convert the x',y',z' coordinates of each vertex in the 3-D polygon-mesh surface representation into the local Cartesian coordinate reference system R<sub>PLIIM/Cartesian</sub> symbolically embedded within the PLIIM-based imager.

STEP 9: At the Image Processing Computer, specify the x',y', z' coordinates of each i-th planar polygon surface patch s(x,y,z) represented in the local Cartesian coordinate reference system  $R_{PLIIM/Cartesian}$ , so as to produce a set of corresponding polygon surface patch  $\{s_i(x',y',z')\}$  represented in system  $R_{PLIIM/Cartesian}$ 

STEP 10: At the Image Processing Computer, for a selected linear high-resolution 2-D image captured at photo-integration time period  $\Delta T_{\rm K}$ , and spatially corresponding to one of the linear 3-D surface profile maps employed at Step 7, use the camera (IFD) parameters used and recorded (i.e. captured) during the corresponding photo-integration time period in order to construct a 3-D vector-based "pixel ray" model specifying the optical formation of each pixel in the linear 2-D image, wherein a pixel ray reflected off a point on the arbitrary 3-D object surface is focused through the camera's image formation optics (i.e. configured by the camera parameters) and is detected at the pixel's detection element in the linear image detection array of the IFD (camera) subsystem.

FIG. 23C3

(C)

STEP 11: At the Image Processing Computer, for each laser beam ray (producing one of the pixels in said selected linear 2-D image), (i) determine which polygon surface patch s<sub>i</sub>(x, y, z) the pixel ray intersects, (ii) compute the x,y, z coordinates of the point of intersection (POI) between the pixel ray and the polygon surface patch represented in Cartesian coordinate reference system R<sub>PLIIM/Cartesian</sub>, and (iii) designate the computed set of points of intersection as {p<sub>i</sub>(x,y,z)}.

STEP 12: At the Image Processing Computer, for each laser beam ray passing through a determined polygon surface patch s(x',y',z') at a computed point of intersection  $p_i(x,y,z)$ , assign the intensity value l(x',y') of the pixel ray to the x', y', z' coordinates of the point of intersection, thereby producing a linear high-resolution 3-D image comprising a 2-D array of pixels, each said pixel pixel having as its attributes (i) an Intensity value l(x',y',z') and (ii) coordinates x', y', z' specified in the local Cartesian coordinate reference system  $R_{PLIIM/Cartesian}$ .

STEP 13: Put the computed linear high-resolution 3-D image in a third FIFO memory storage structure in the image processing computer.

STEP 14: Repeat Steps 1-6 to update the first and second FIFO data queues maintained in the image processing computer, and Steps 7-13 to update the consecutively computed linear high-resolution 3-D image stored in the third FIFO memory storage structure.

STEP 15: Assemble in an image buffer in the image processing computer, a set of consecutively computed linear high-resolution 3-D images retrieved from the third FIFO data storage device so as to construct an "area-type" high-resolution 3-D image of said arbitrary 3-D object surface.

FIG. 23C4

(D)

STEP 16: At the Image Processing Computer, map the intensity value I(x', y', z') of each pixel in the computed area-type 3-D image onto the x',y',z' coordinates of the points on a uniformly-spaced apart "grid" positioned perpendicular to the optical axis of the camera subsystem (i.e. to model the 2-D planar substrate on which the forms of graphical intelligence was originally rendered), wherein said mapping process involves using an intensity weighing function based on the x', y', z' coordinate values of each pixel in the area-type high-resolution 3-D image, thereby producing an area-type high-resolution 2-D image of the 2-D planar substrate surface bearing said forms of graphical intelligence (e.g. symbol character strings).

STEP 17: At the Image Processing Computer, use said OCR algorithm to perform automated recognition of graphical intelligence contained in said area-type high-resolution 2-D image of said 2-D planar substrate surface so as to recognize said graphical intelligence and generate symbolic knowledge structures representative thereof.

STEP 18: Repeat Steps 1-17 as often as required to recognize changes in graphical intelligence on the arbitrary moving 3-D object surface.

FIG. 23C5

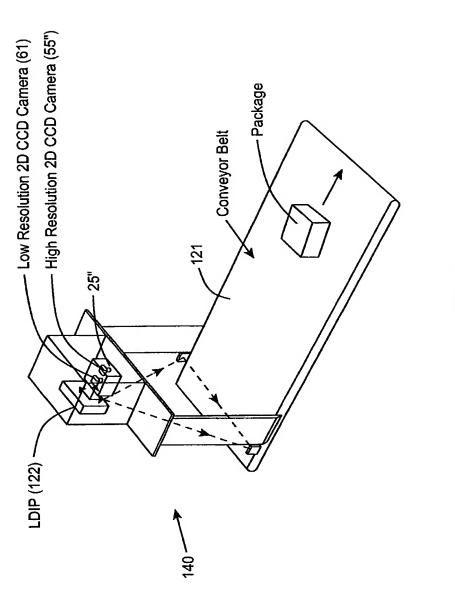
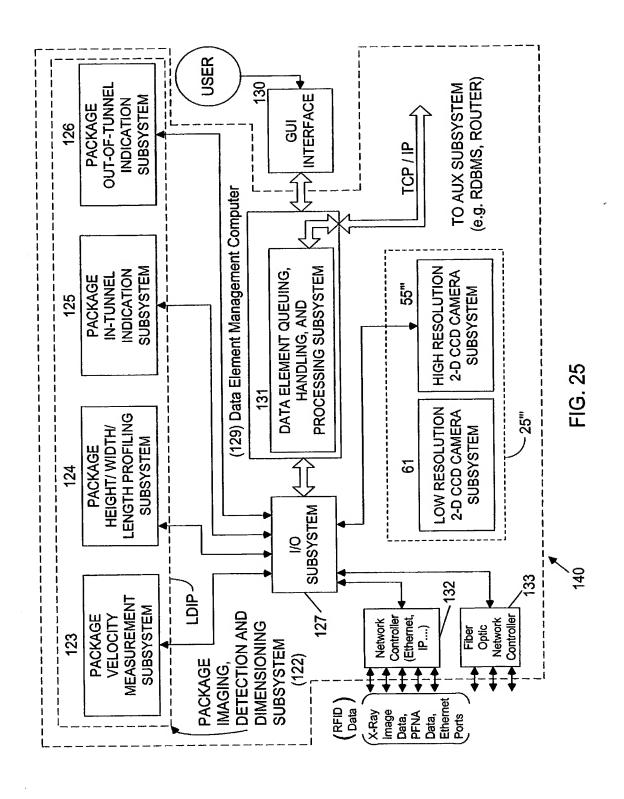
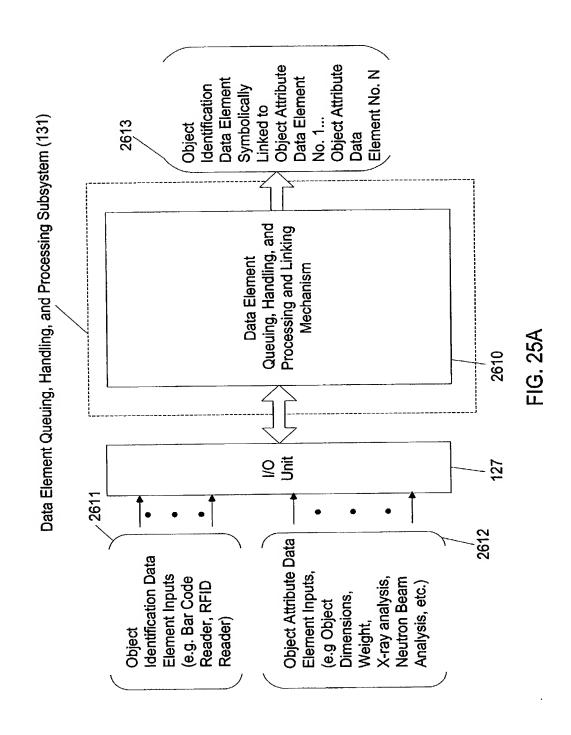
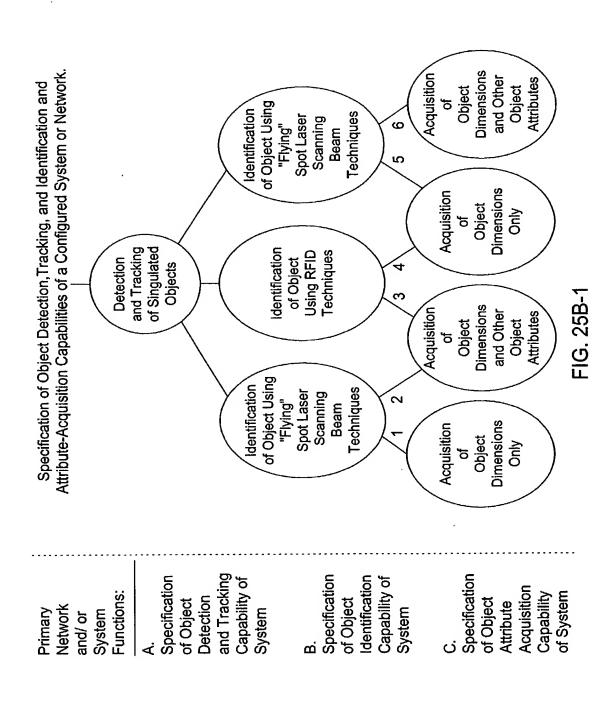
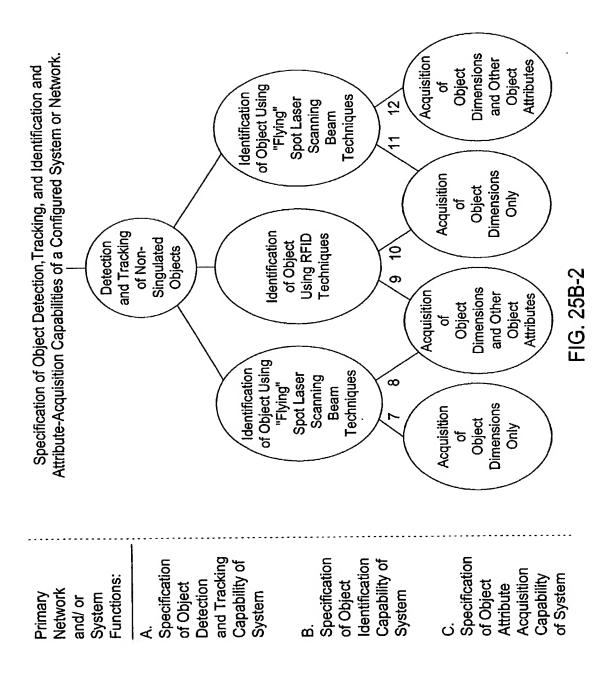


FIG. 24









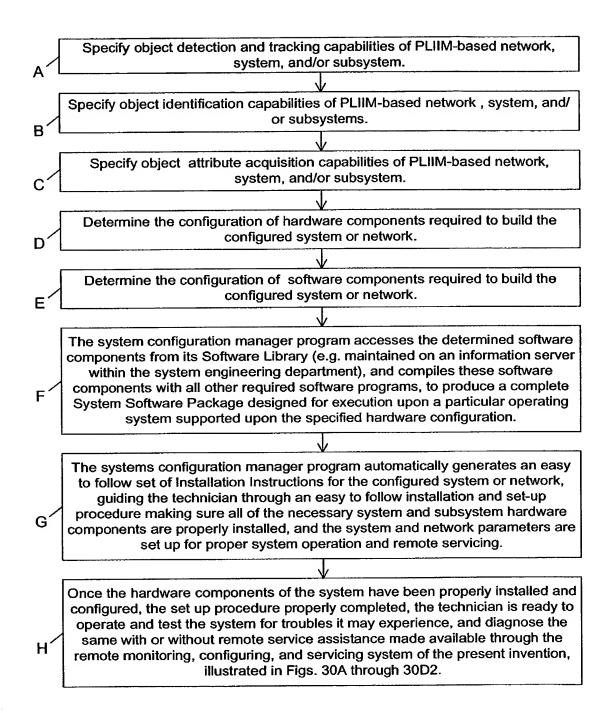
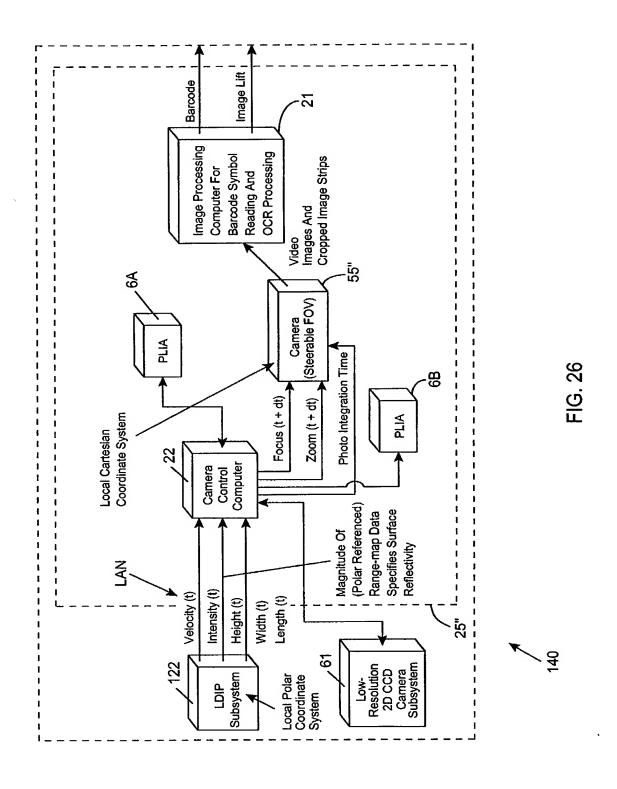


FIG. 25C



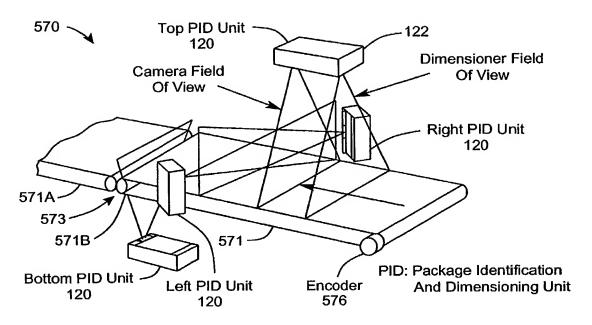
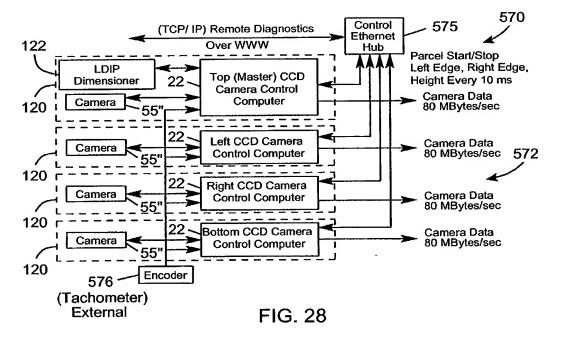


FIG. 27



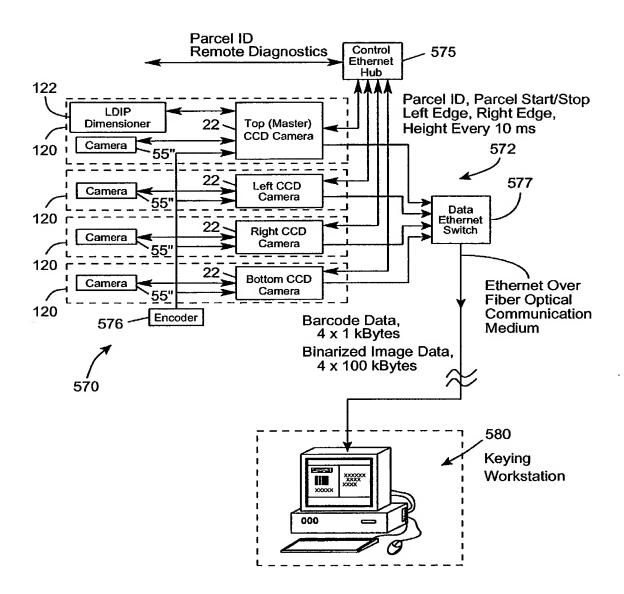


FIG. 29



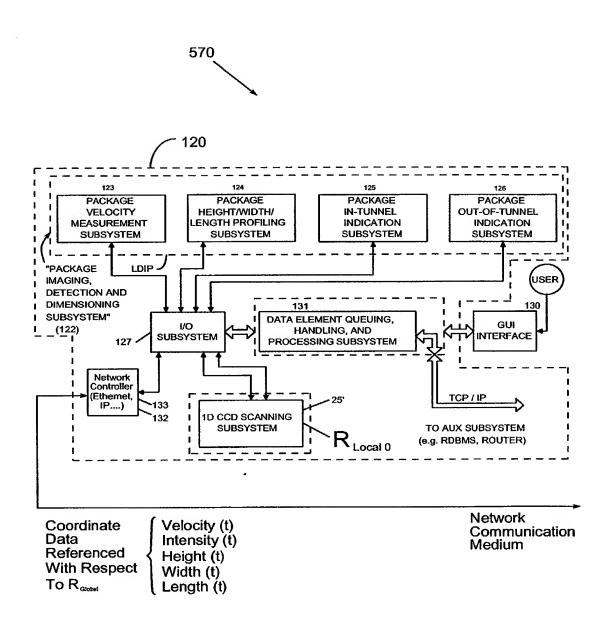


FIG. 30-1

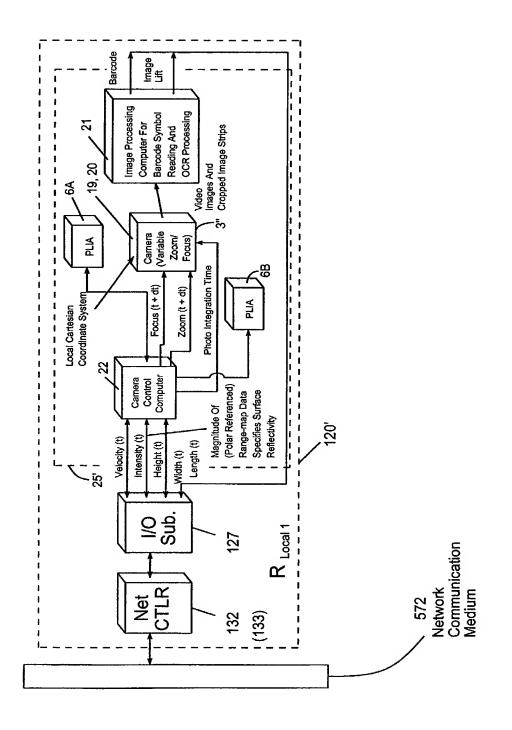
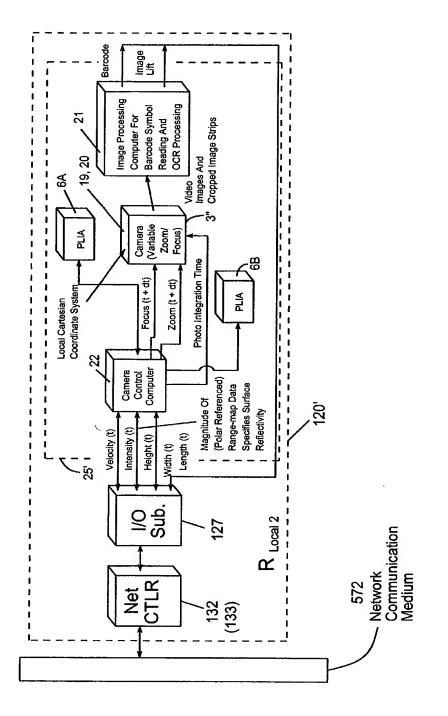
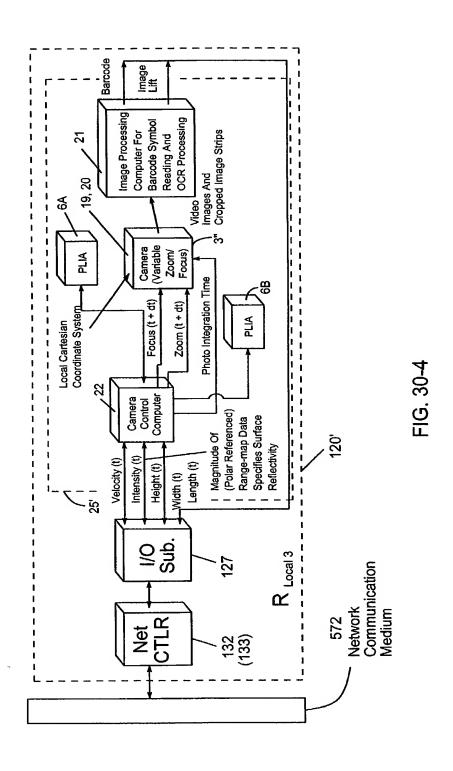
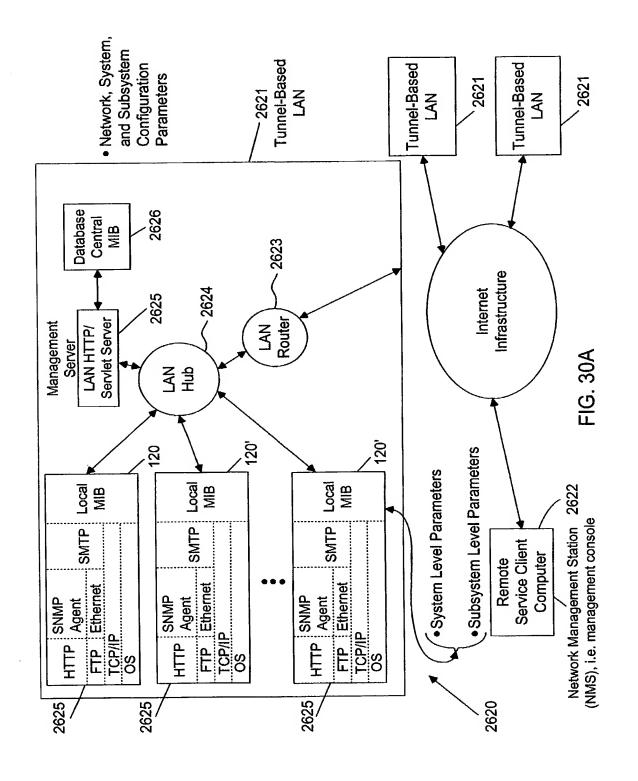


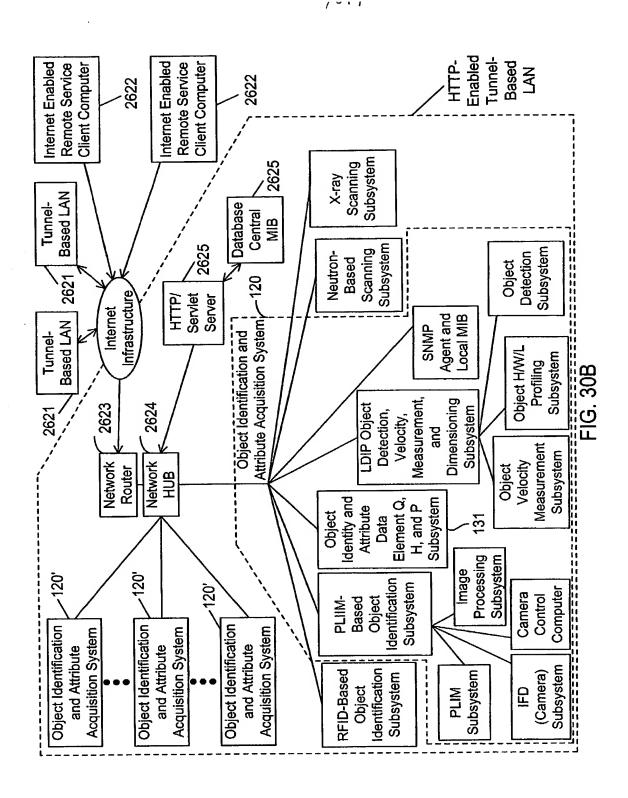
FIG. 30-2



<del>-</del>1G. 30-3







## **Network Configuration Parameters:**

Router IP address; no. of nodes (i.e. systems) in LAN; passwords, LAN location; name of customer facility; technical contact; phone no.; domain name; object identity codes; object attribute acquisition codes;.....] System Configuration Parameters:

System IP Address; passwords; object identity codes; object attribute acquisition codes;....]

# Monitorable and/or Configurable Parameters for Subsystems Within Each System:

generate object subsystems parameters identity

This system links parameters(i.e. object attribute data element

data element) to parameters (i.e. object atrribute corresponding object identify object identity data element)

generate object subsystems attribute These

 PLIIM-based object identification subsystem: [ object identity code; object attribute acquisition codes;....] PLIM Subsystem: [VLD status; power VLD; TIM function; temp.;....]

IFD ( Camera) Subsystem: [sensor temp; .....]

 Image Processing Subsystem (Computer): [processor load history; system up time; # of frames (pgs); barcode read rate; current line rate;....]

Camera Contact Subsystem (Computer): [number of frames dropped; number of focused zoom commands; number and kinds of motor control errors;....]

RFID-based object identification subsystem: [....]

Object identity and attribute data element queuing, handling and processing subsystem: [....]

LDIP object identification, velocity-measurement, and dimensioning subsystem: [....]

 Object velocity measurement subsystem: [polygon RPM; polygon laser output X; channel X drift; channel X noise; trigger error events; instant lock reference drift; temperature]

Object H/W/L profiling subsystem

Object detection subsystem: [non-singulation/singulation code;....]

X-ray scanning subsystem: [....]

Neutron-beam scanning subsystem: [....]

**parameters** 

FIG. 30C

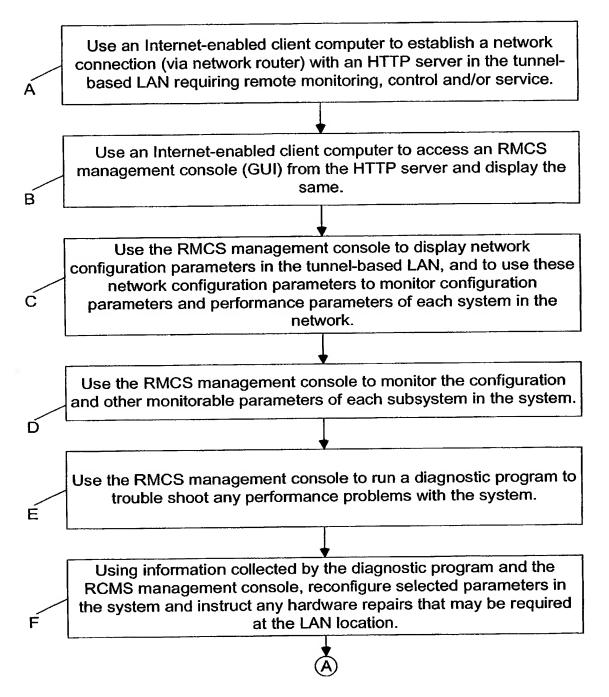


FIG. 30D1

7/ -17

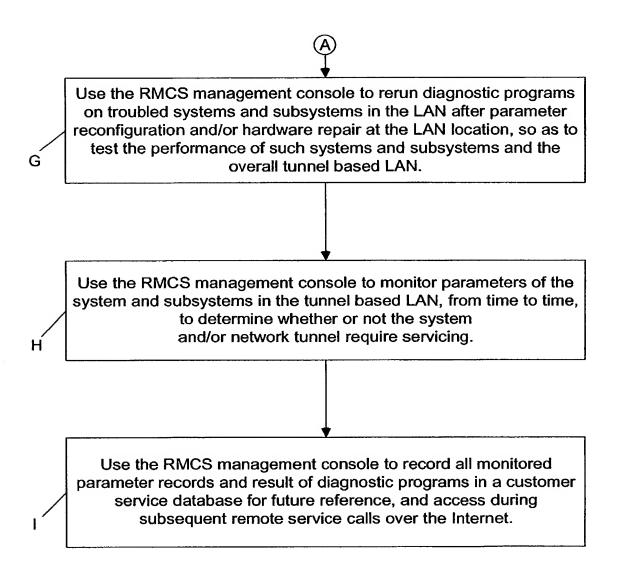


FIG. 30D2

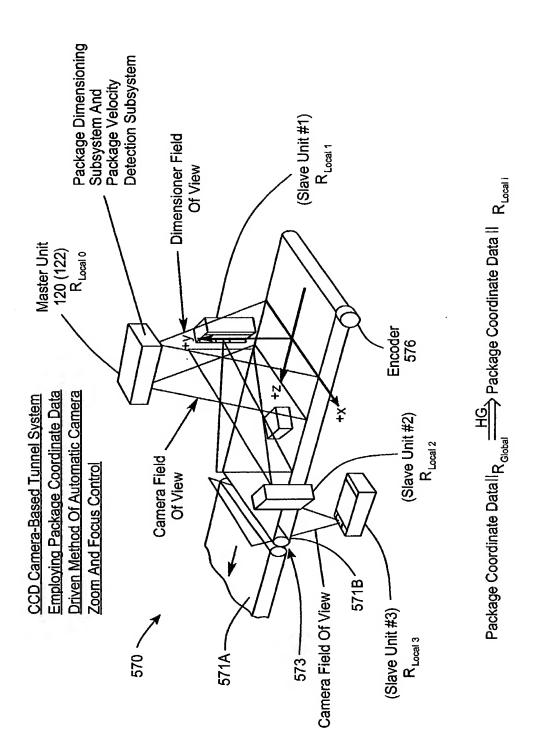


FIG. 31

1 - - 1

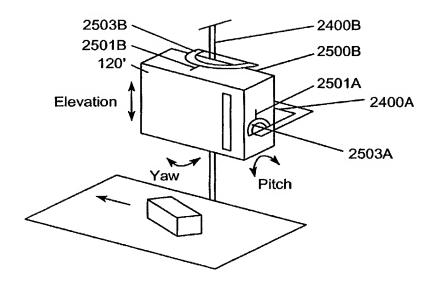


FIG. 31A

**1** 

For each package transported through tunnel system, the master unit (with package dimensioning subsystem and velocity detection subsystem) generates package height, width, length and velocity data (H, W, L, V)<sub>G</sub>, referenced with respect to global coordinate reference system R<sub>Global</sub> and transmits such package dimension data to each slave unit downstream, using the systems data communication network.

Each slave unit receives the transmitted package height, width, and length data {H, W, L, V}<sub>G</sub> and converts this coordinate information into the slave unit's local coordinate reference system R<sub>Local I</sub>, {H, W, L, V}<sub>I</sub>

The camera control computer in each slave unit uses the converted package height, width, length data {H, W, L}<sub>i</sub> and package velocity data to generate camera control signals for driving the camera subsystem in the slave unit to zoom and focus in on the transported package as it moves by the slave unit, while ensuring that captured images having substantially constant O.P.I. Resolution and 1:1 aspect ratio.

FIG. 32A

Each slave unit captures images acquired by its intelligently controlled camera subsystem, buffers the same, and processes the images to decode bar code symbol identifiers represented in said images, and/ or to perform optical character recognition (OCR) thereupon.

The slave unit which decodes a bar code symbol in a processed image automatically transmits a package identification data element (containing symbol character data representative of the decoded bar code symbol) to the master unit (or other designated system control unit employing data element management functionalities) for package data element processing.

Master unit time-stamps received package identification data element, places said data element in a data queue, and processes package identification data elements and time-stamped package dimension data elements in said queue to link each package identification data element with one said corresponding

FIG. 32B

package dimension data element.

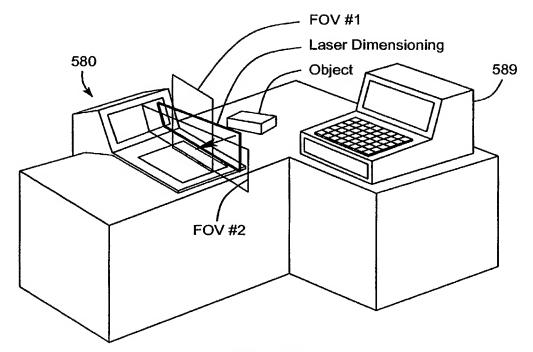


FIG. 33A

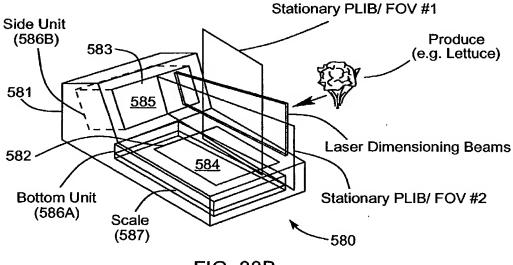
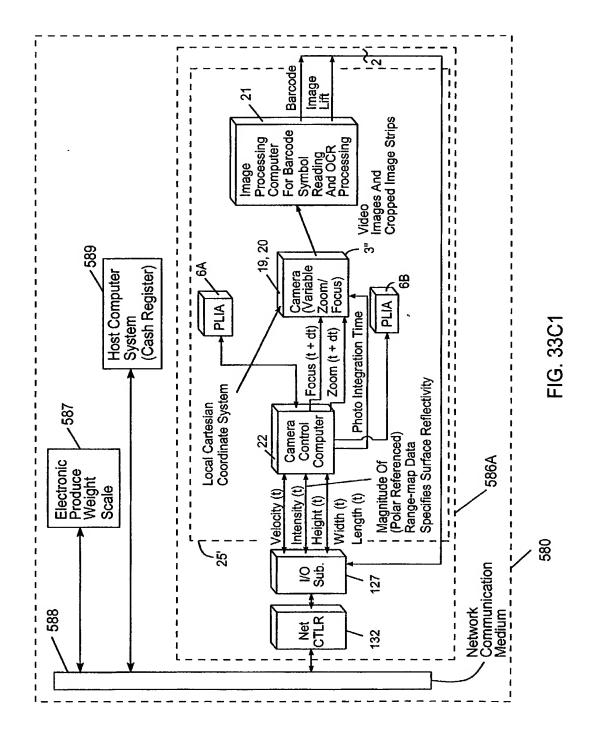
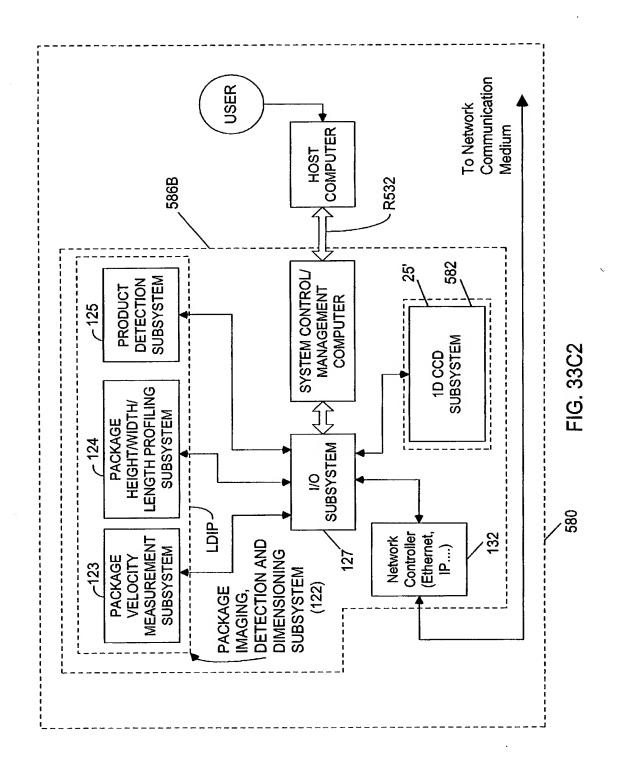


FIG. 33B





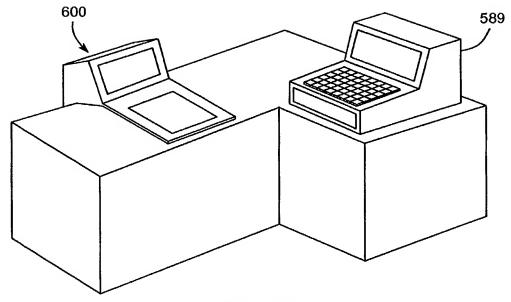


FIG. 34A

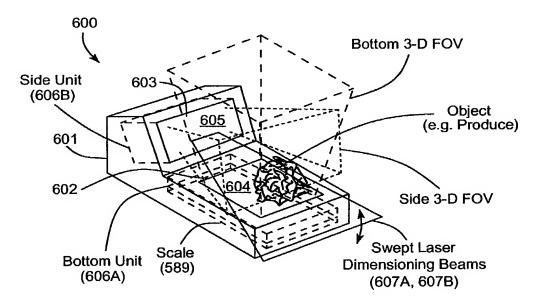
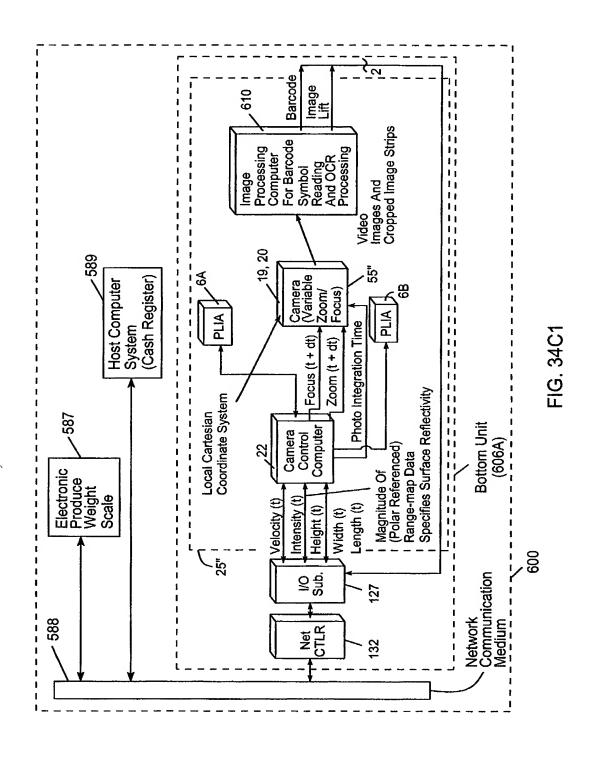
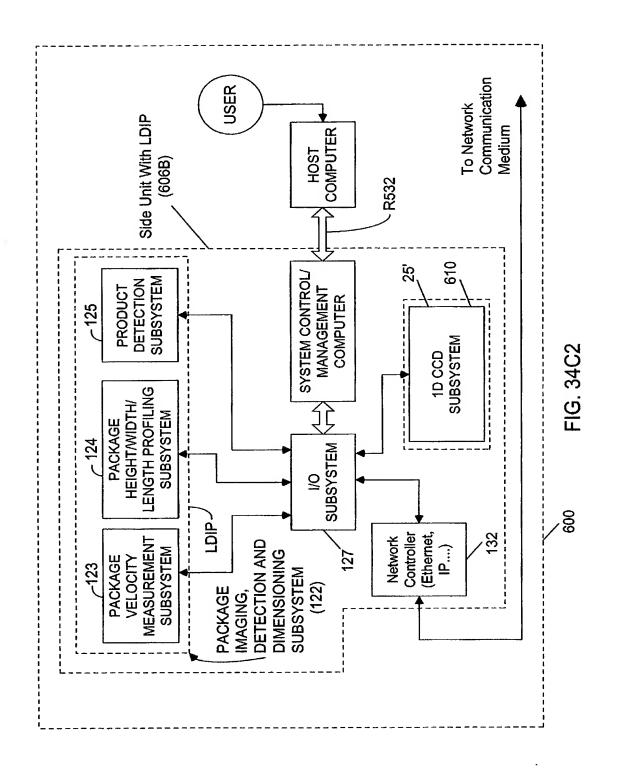


FIG. 34B





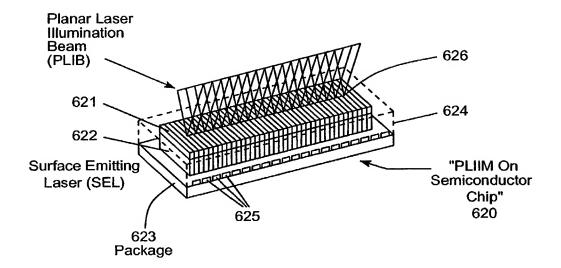


FIG. 35A

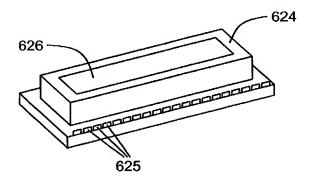
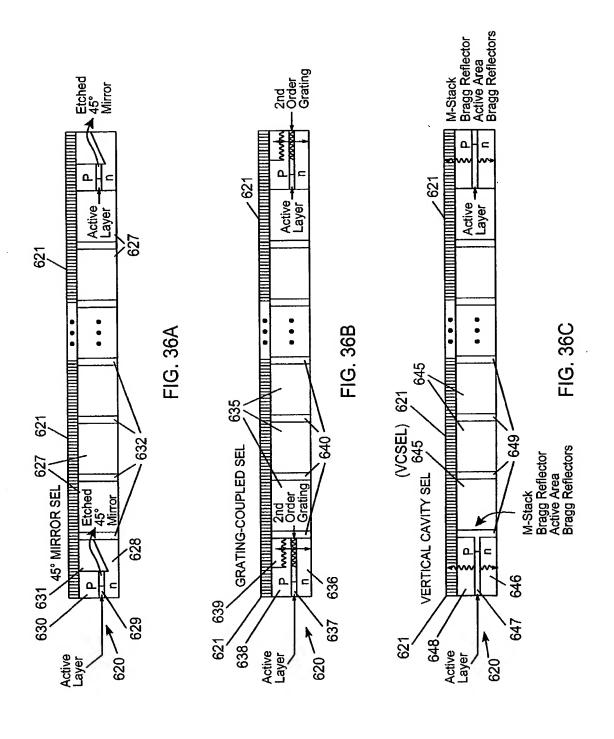


FIG. 35B



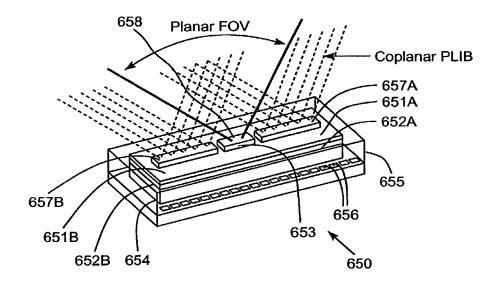


FIG. 37

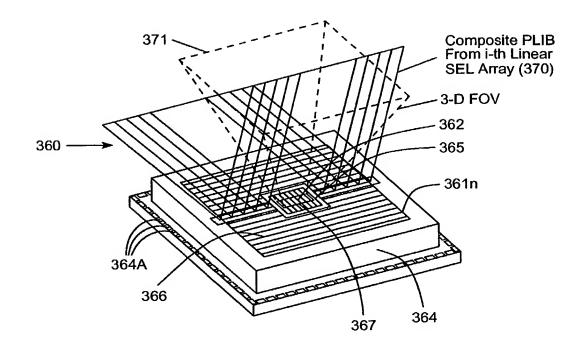


FIG. 38A

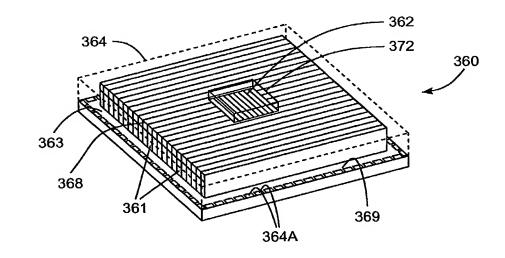


FIG. 38B

-1 -11

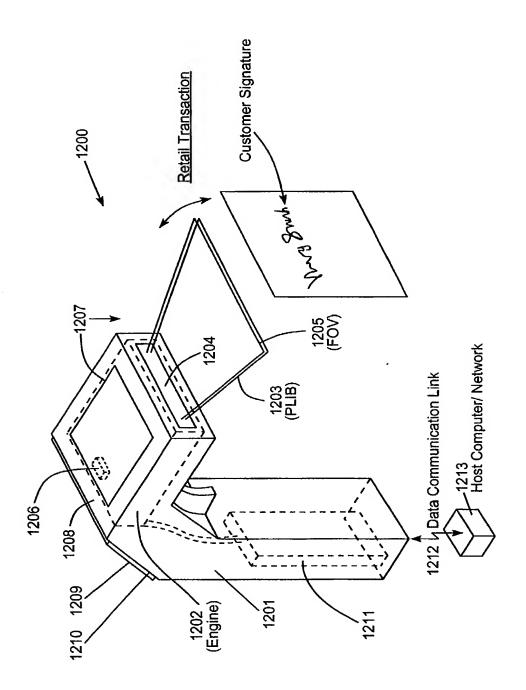


FIG. 39A

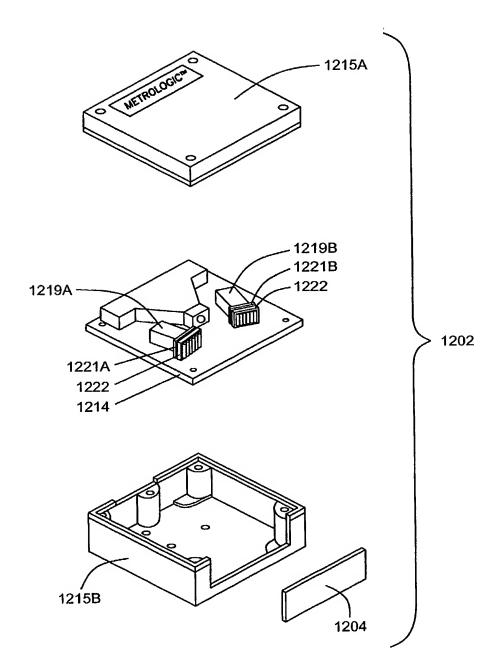


FIG. 39B

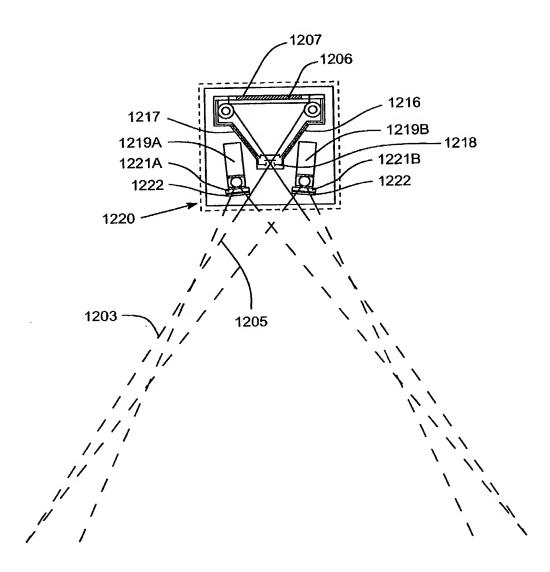


FIG. 39C

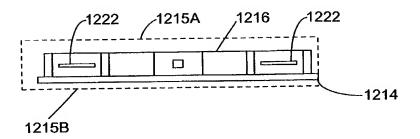


FIG. 39D

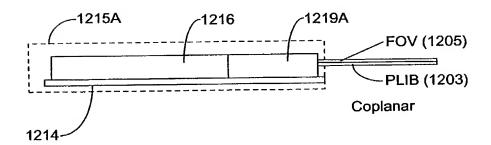


FIG. 39E

## 41T/37+

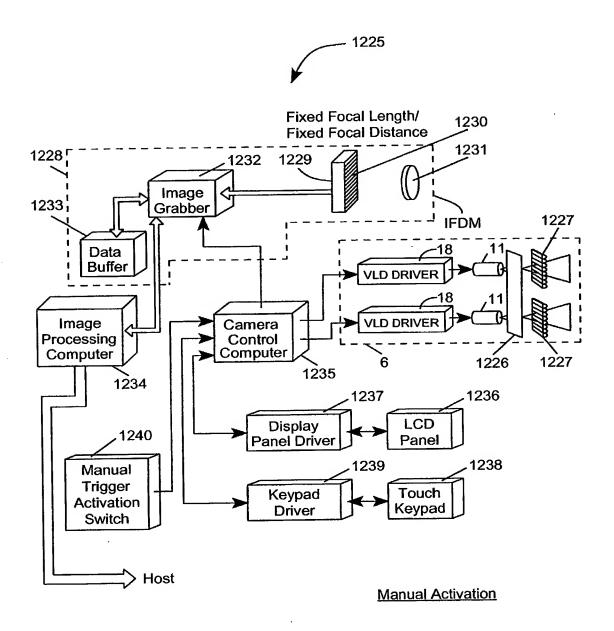
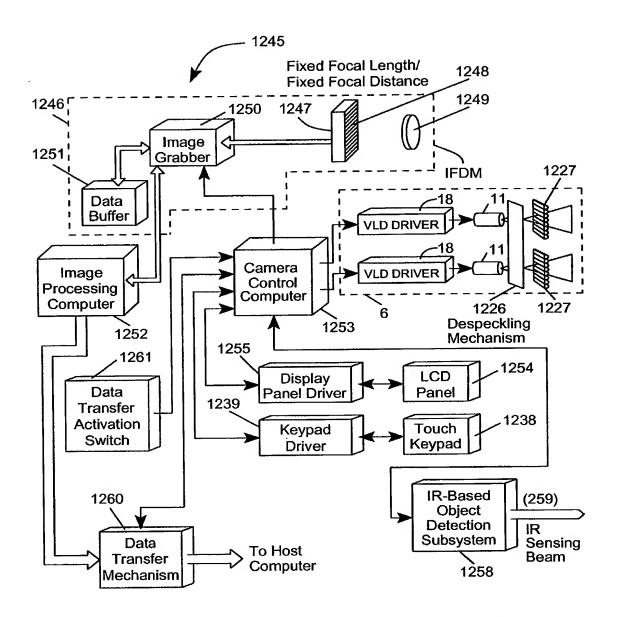


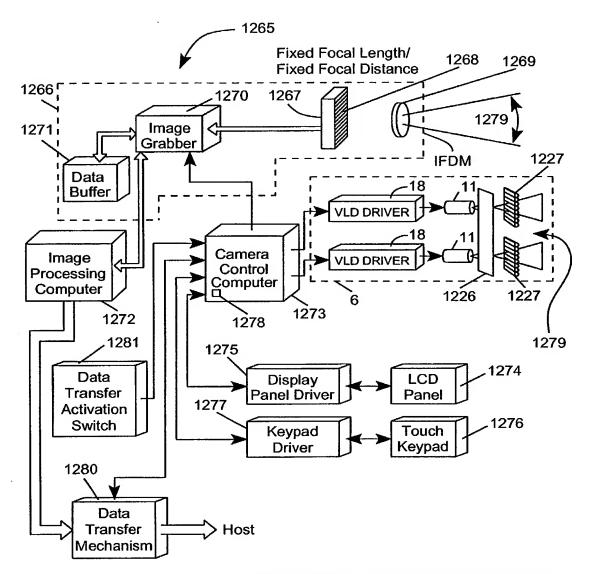
FIG. 40A1



Automatic with IR Object Detection

FIG. 40A2

7011



Automatic with Laser Based Object Detection

FIG. 40A3

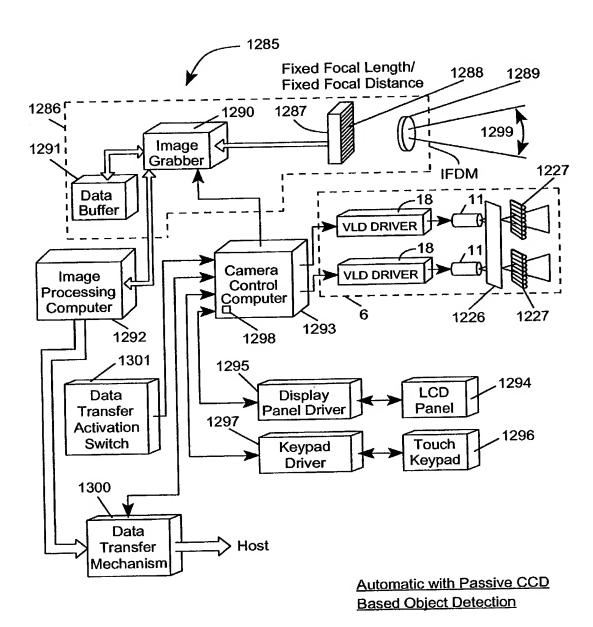


FIG. 40A4

### 446/100

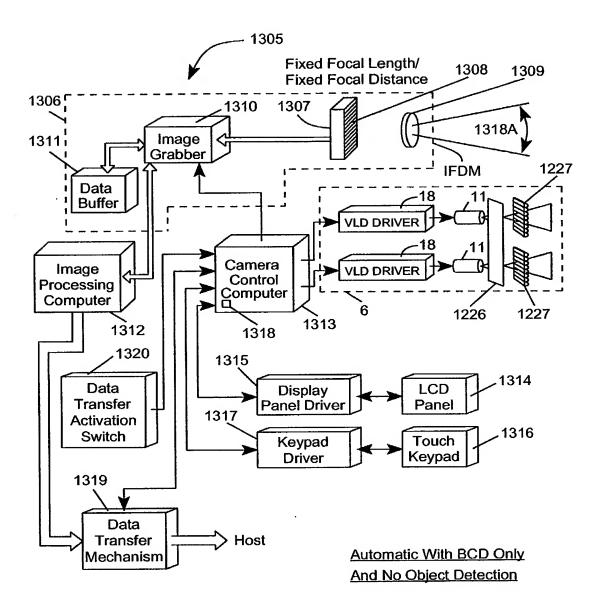


FIG. 40A5



### 204017

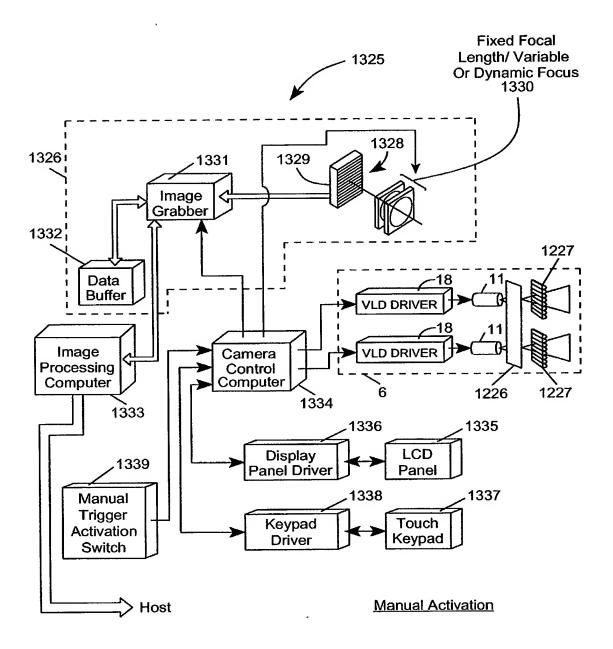
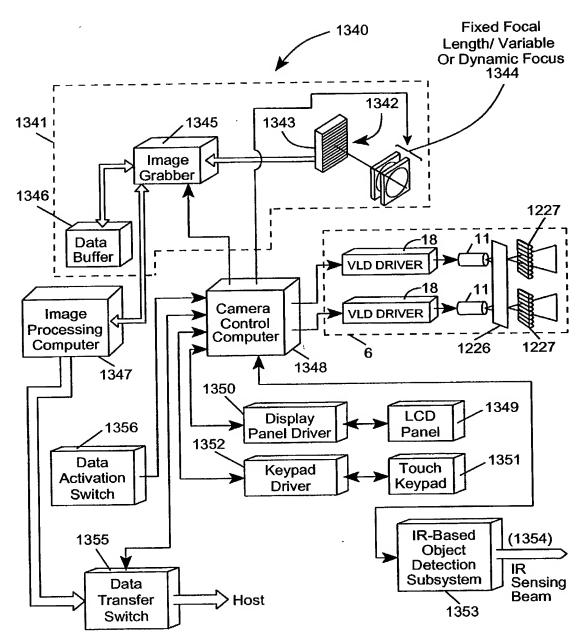


FIG. 40B1



Automatic With IR-Based Object Detection

FIG. 40B2

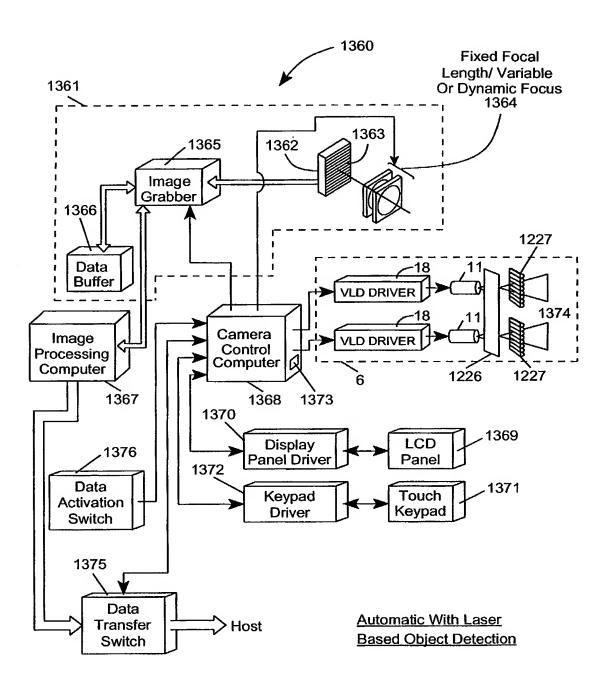


FIG. 40B3

7 - 1 1

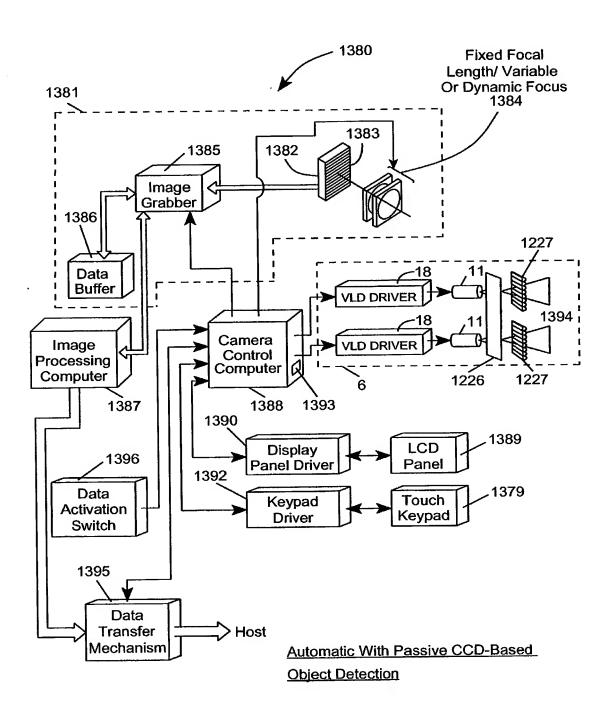


FIG. 40B4

---1017

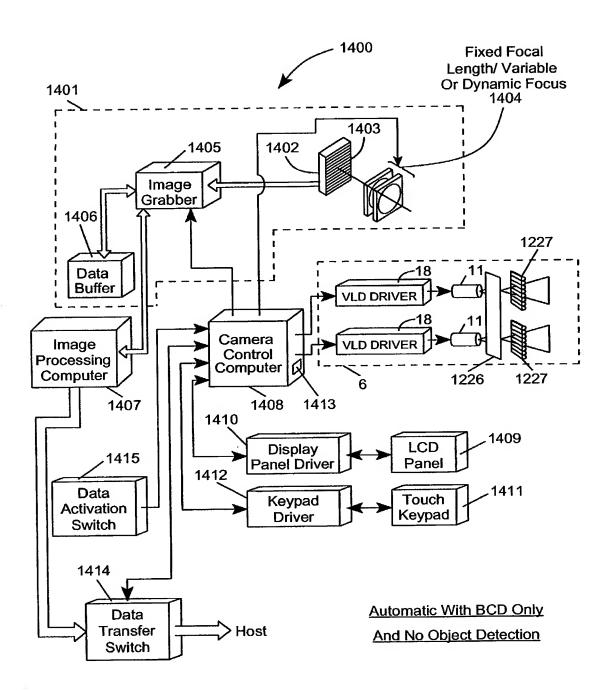


FIG. 40B5

### 415/100

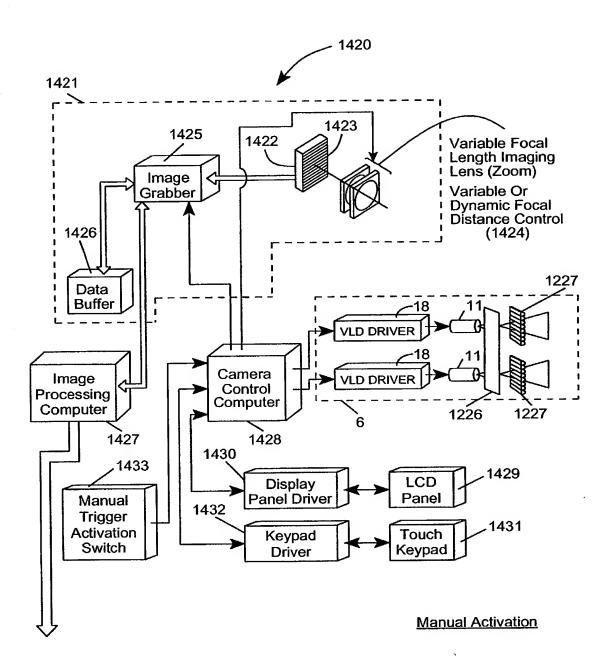


FIG. 40C1

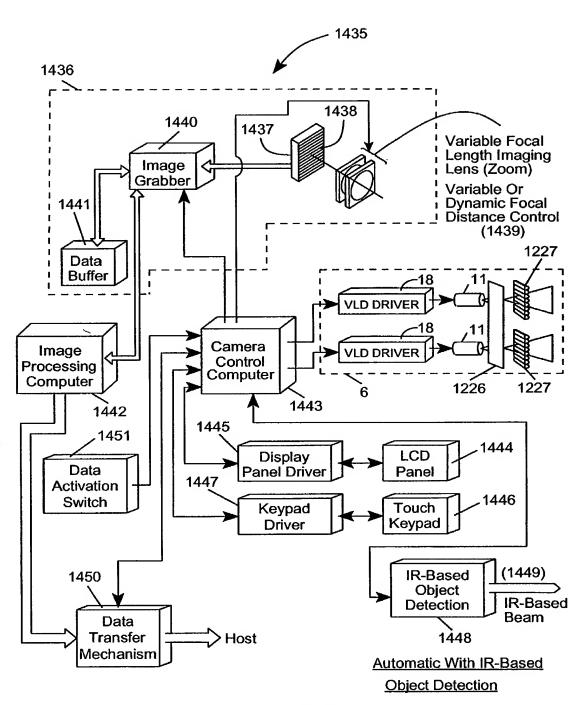


FIG. 40C2

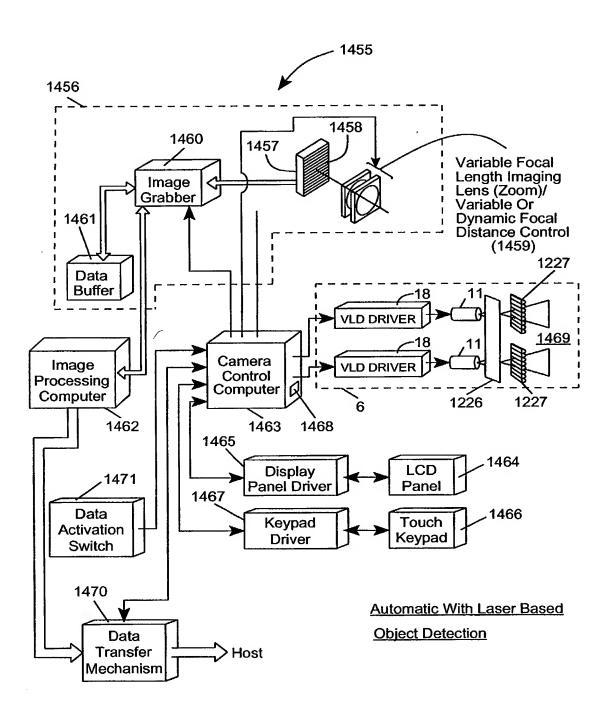


FIG. 40C3

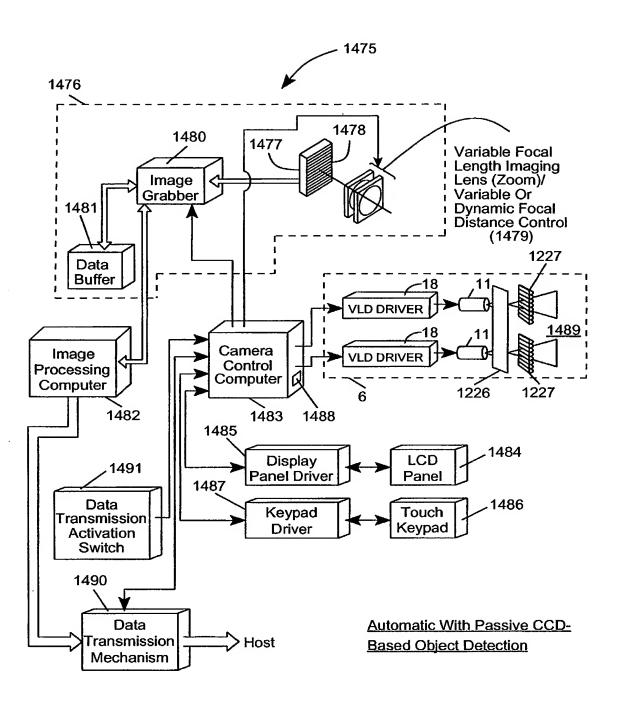


FIG. 40C4



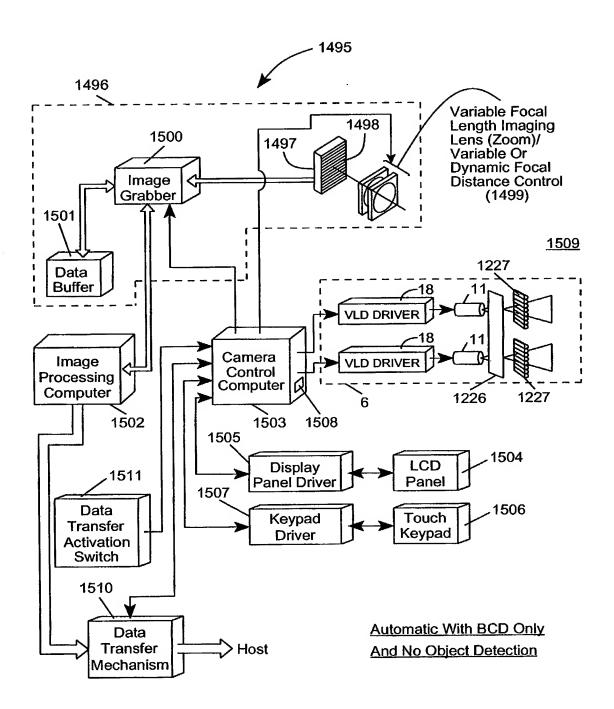


FIG. 40C5

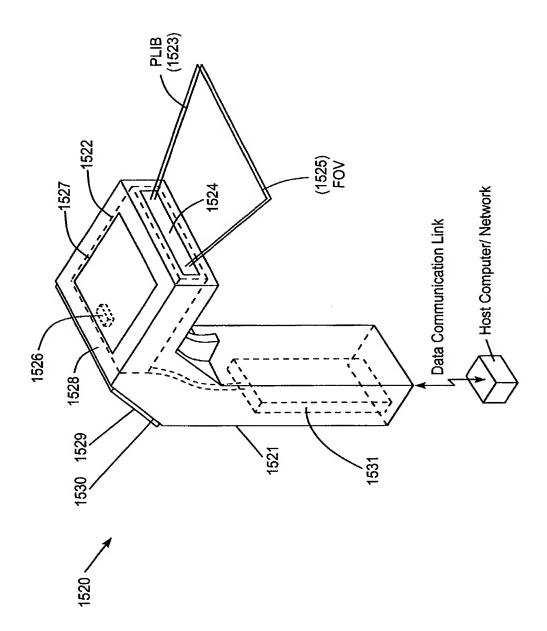
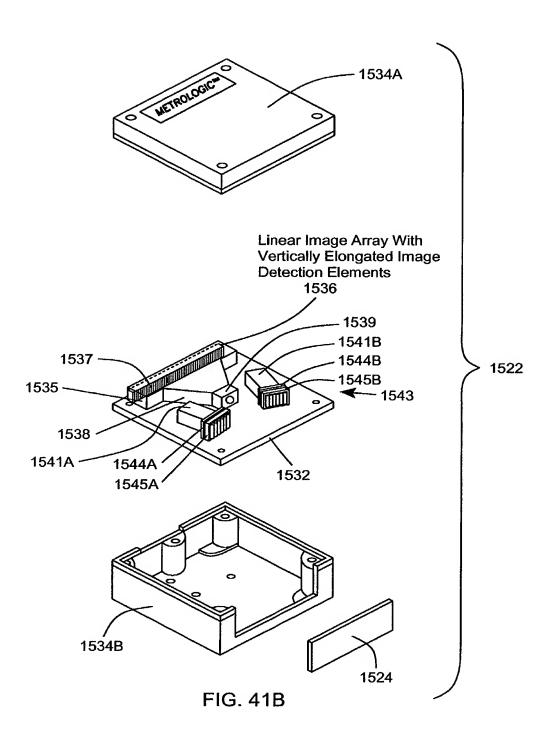


FIG. 41A

1-11





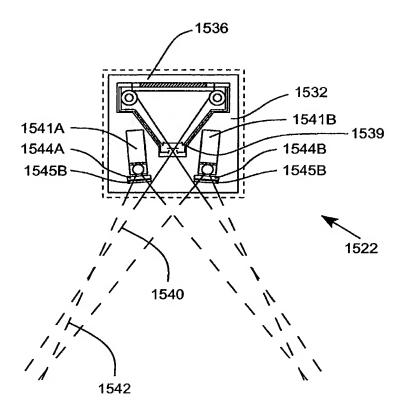


FIG. 41C

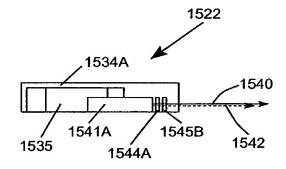
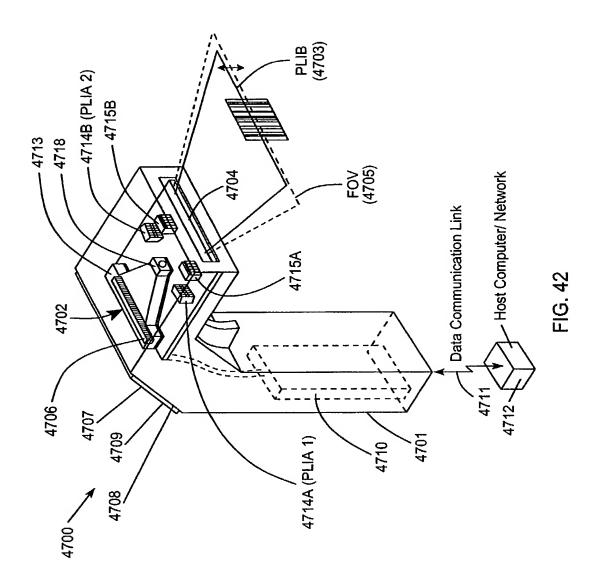


FIG. 41D



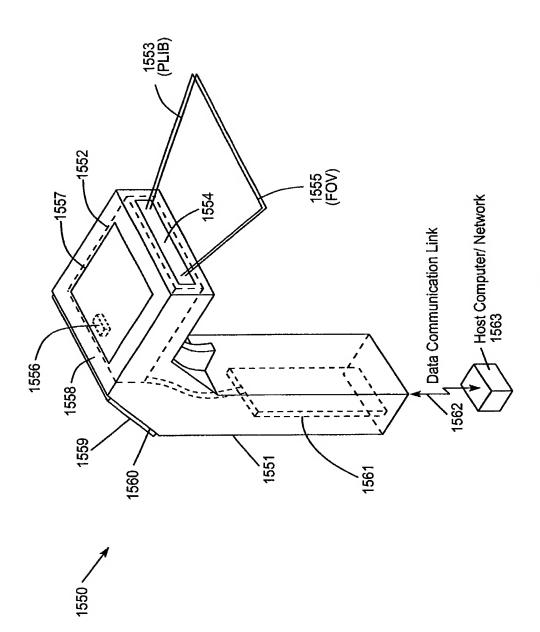


FIG. 42A

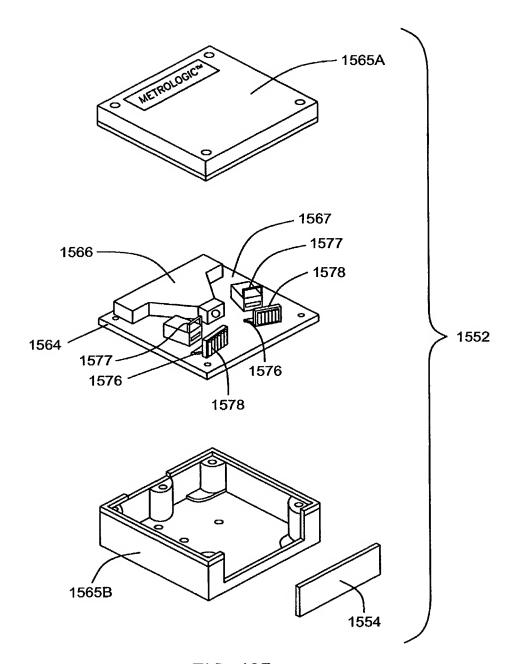


FIG. 42B

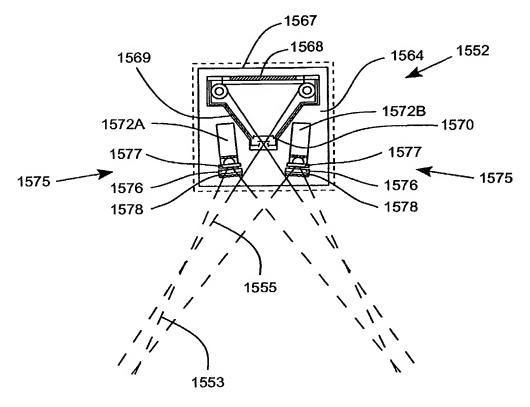


FIG. 42C

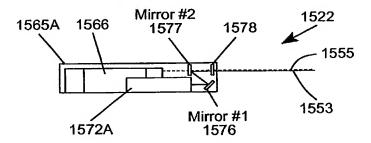


FIG. 42D

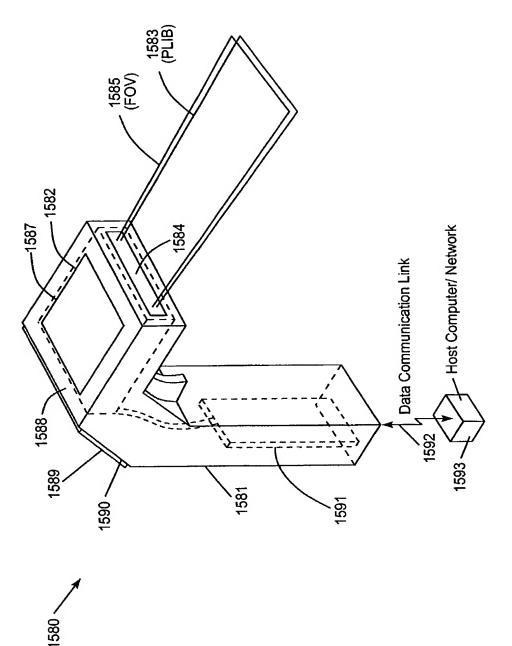


FIG. 43A

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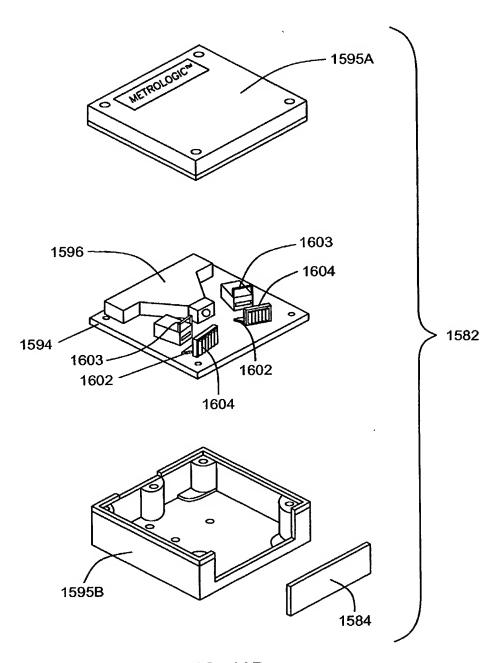


FIG. 43B



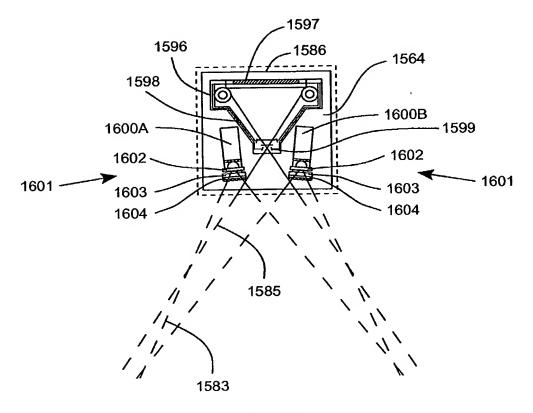


FIG. 43C

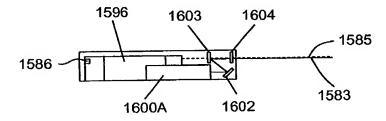


FIG. 43D

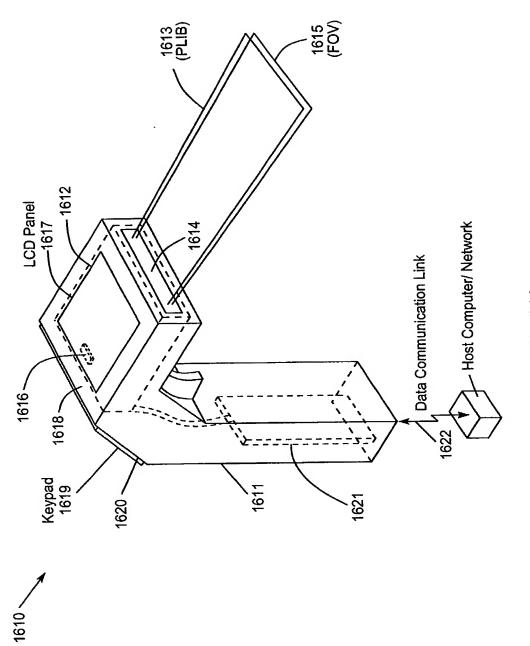


FIG. 44A

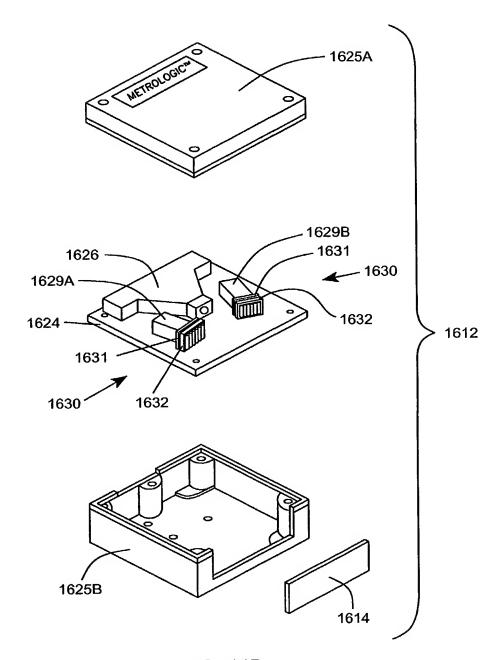


FIG. 44B



1 - 11

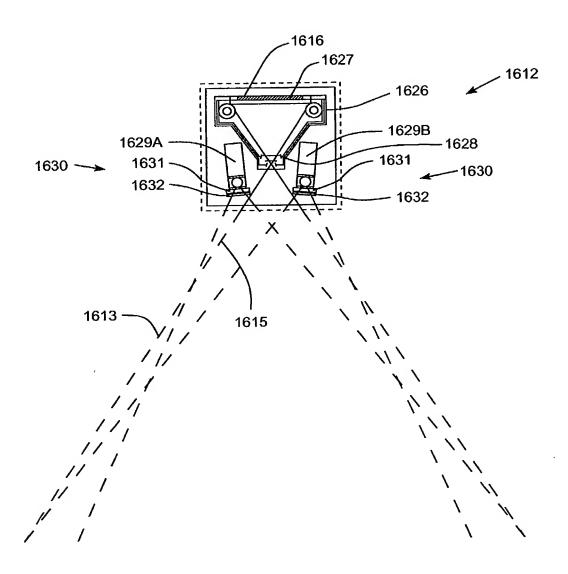
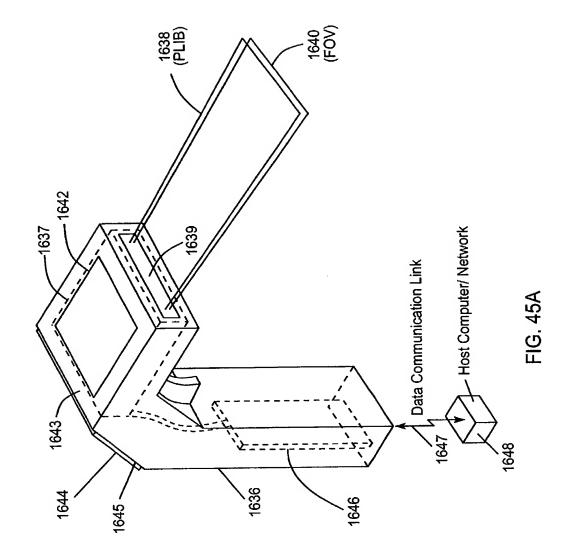


FIG. 44C



635

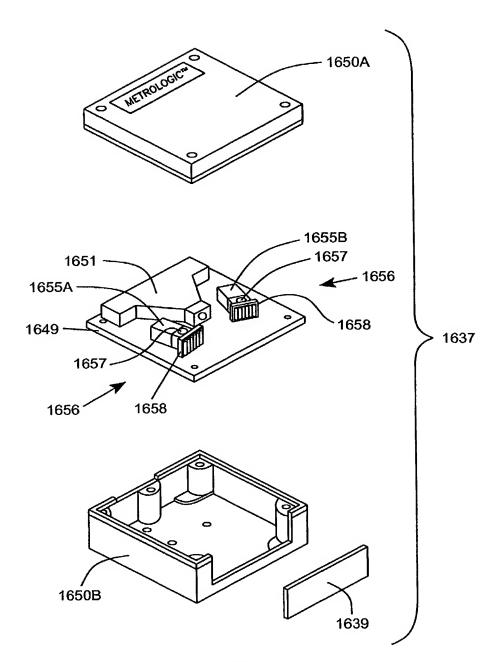


FIG. 45B

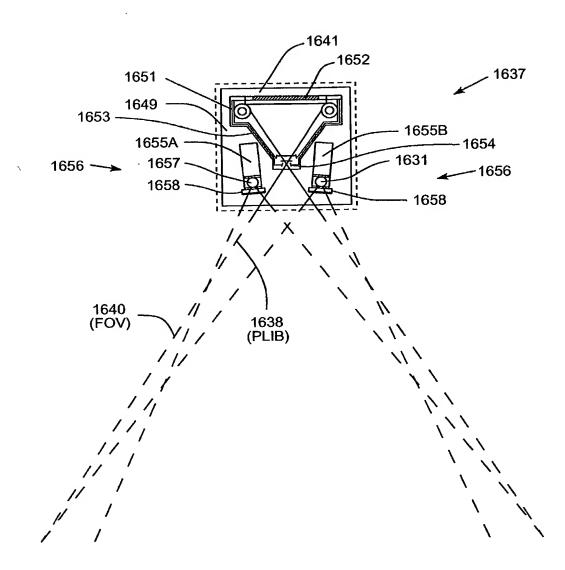
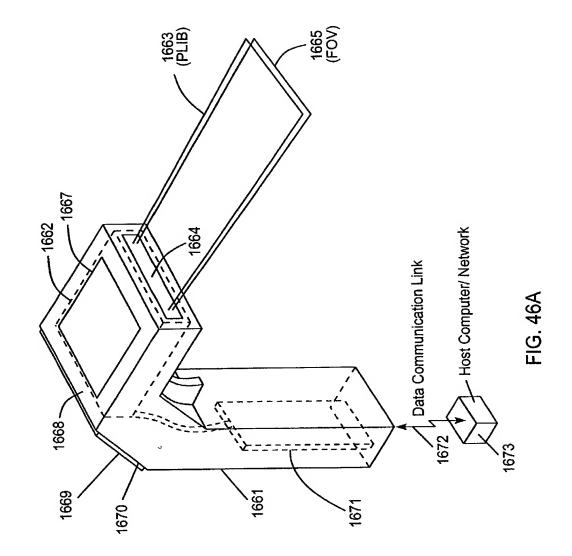


FIG. 45C









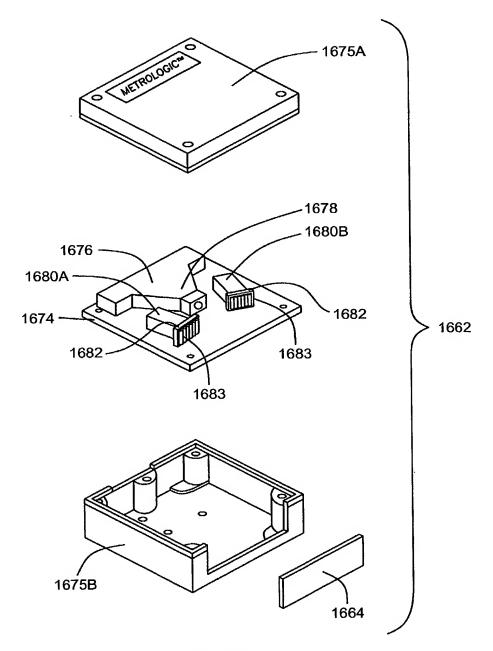


FIG. 46B



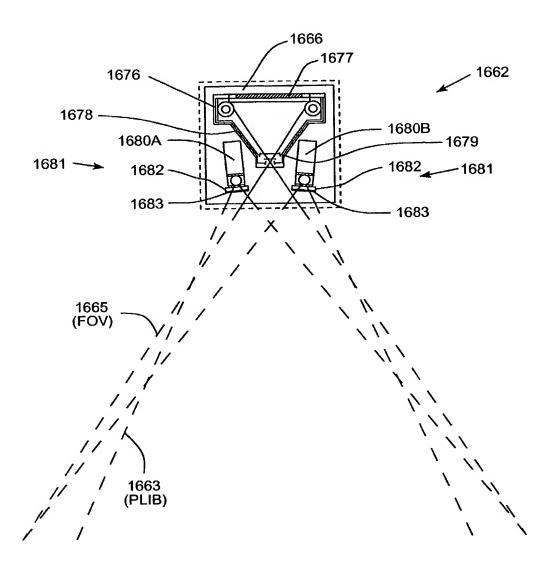
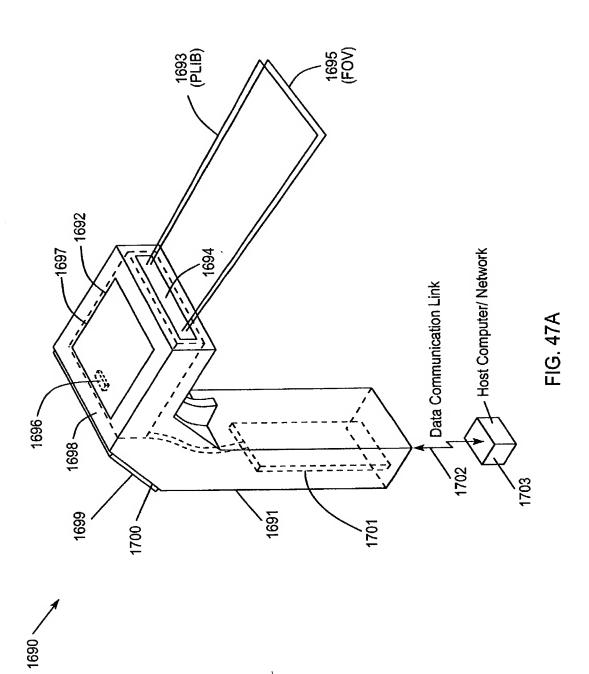


FIG. 46C



- 1011

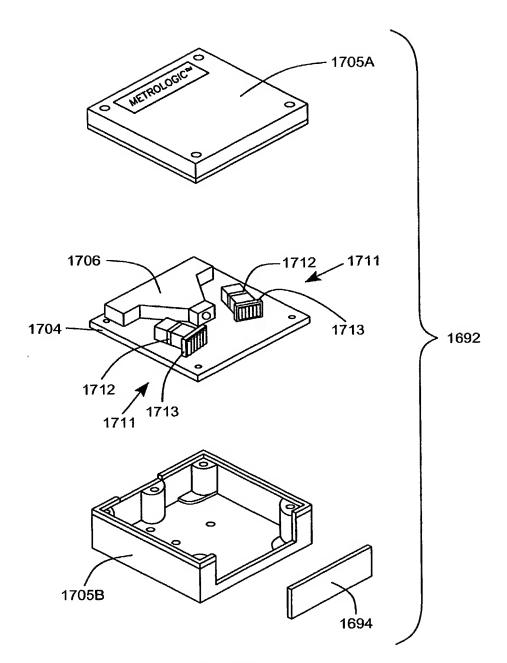


FIG. 47B

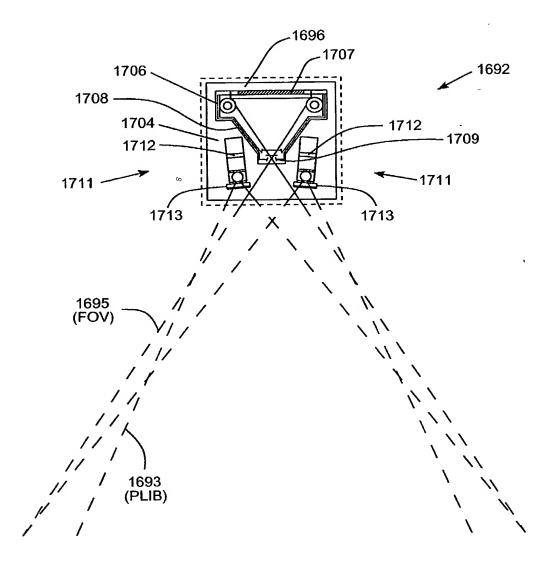
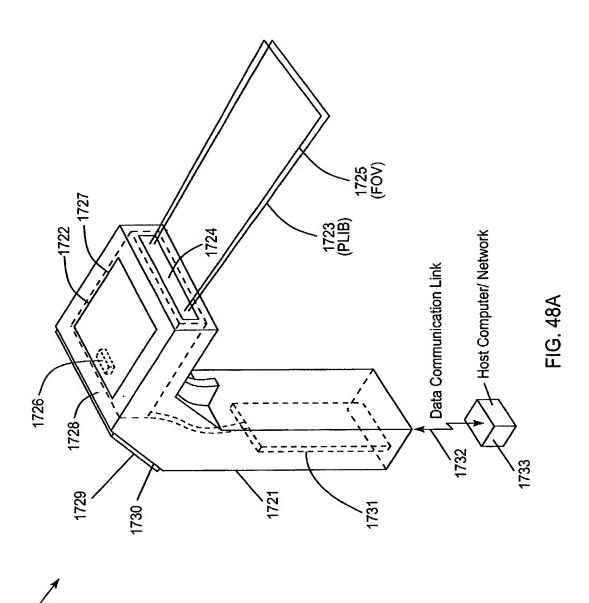


FIG. 47C





1001

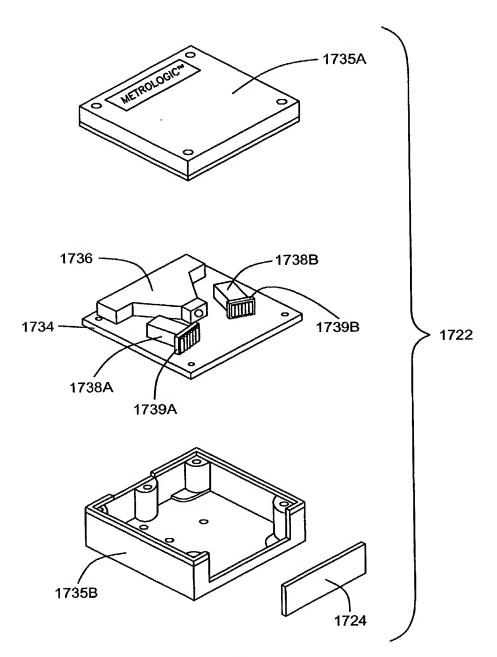


FIG. 48B

1 - 1 1

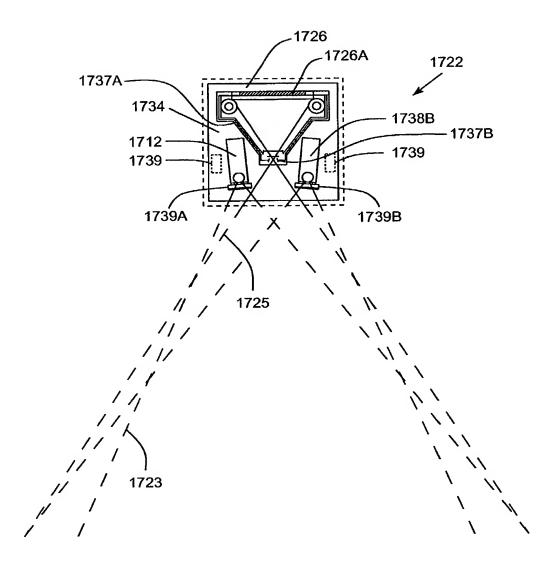
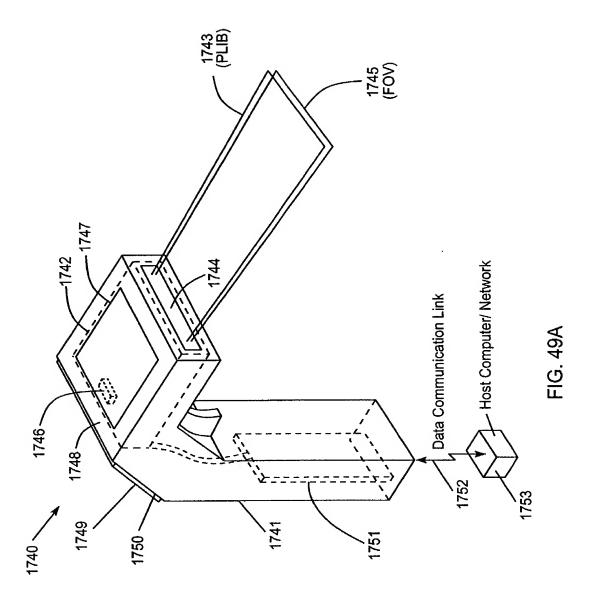


FIG. 48C





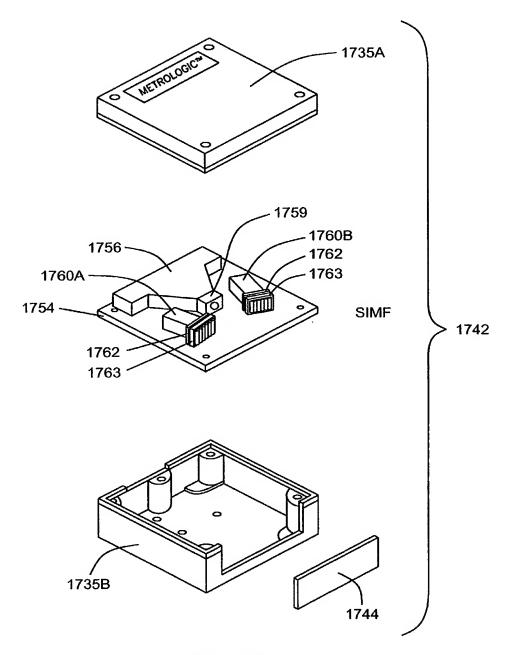


FIG. 49B



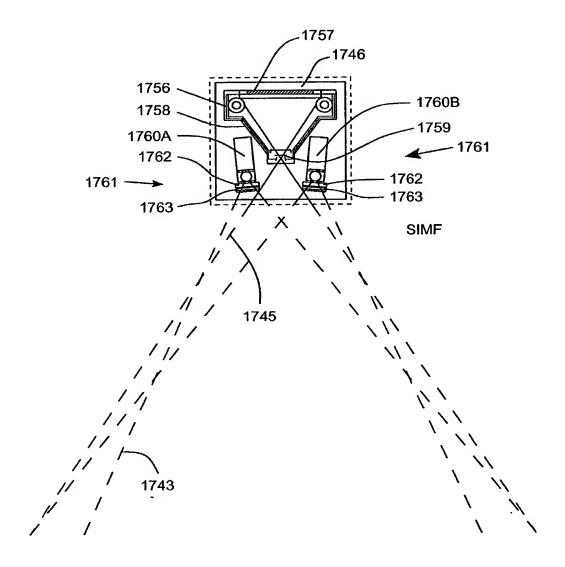
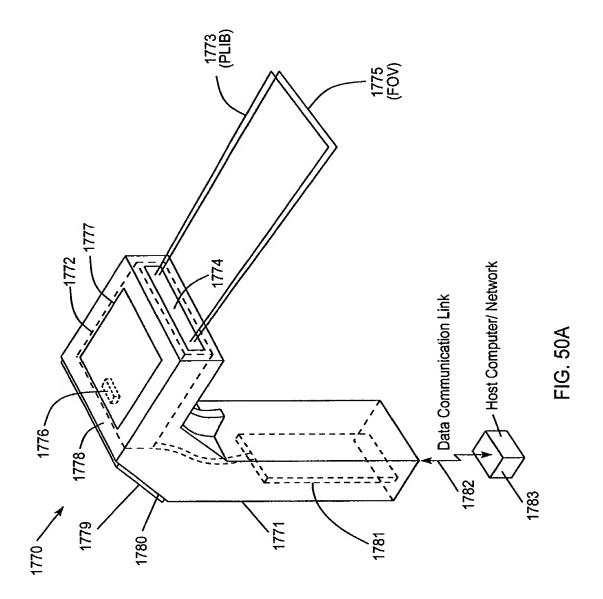


FIG. 49C





1 - -

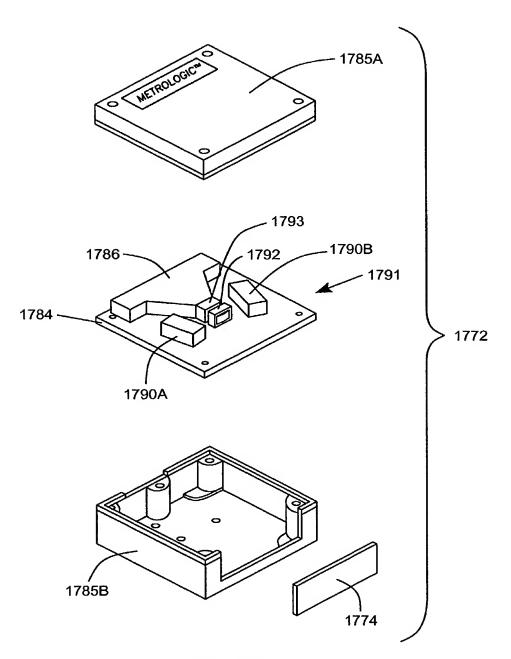
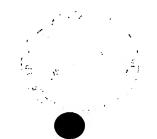


FIG. 50B



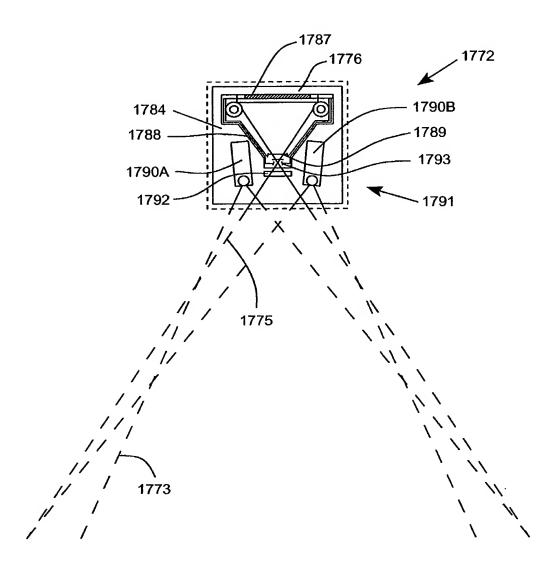
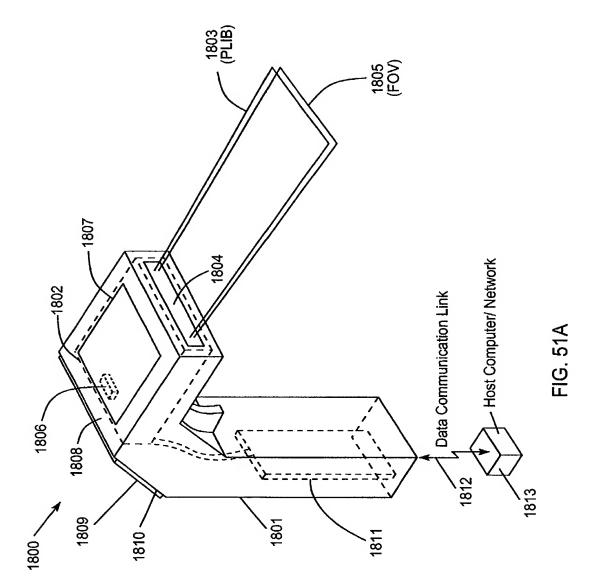


FIG. 50C



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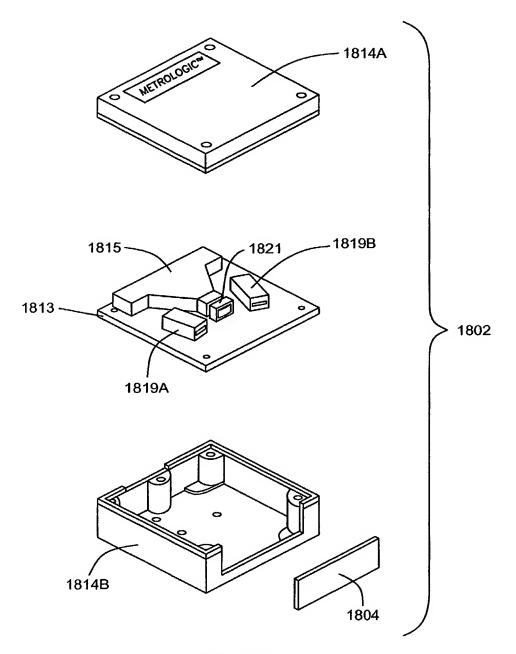


FIG. 51B

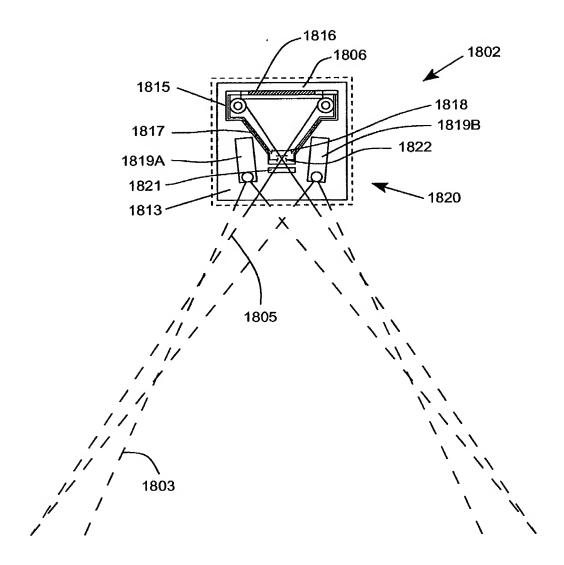
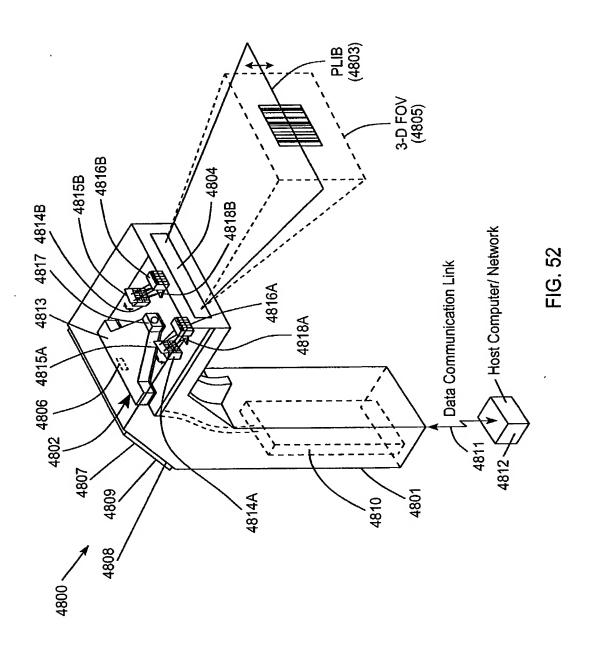
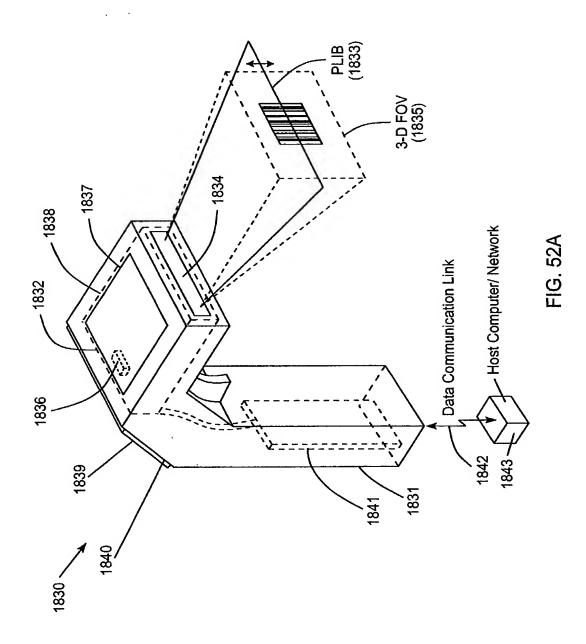
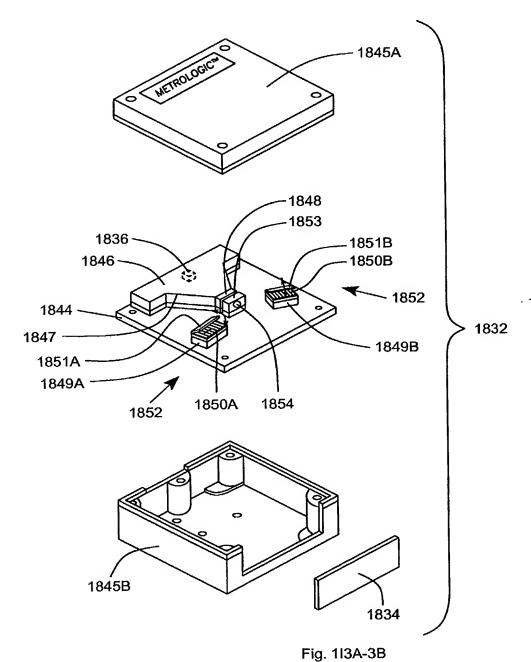


FIG. 51C



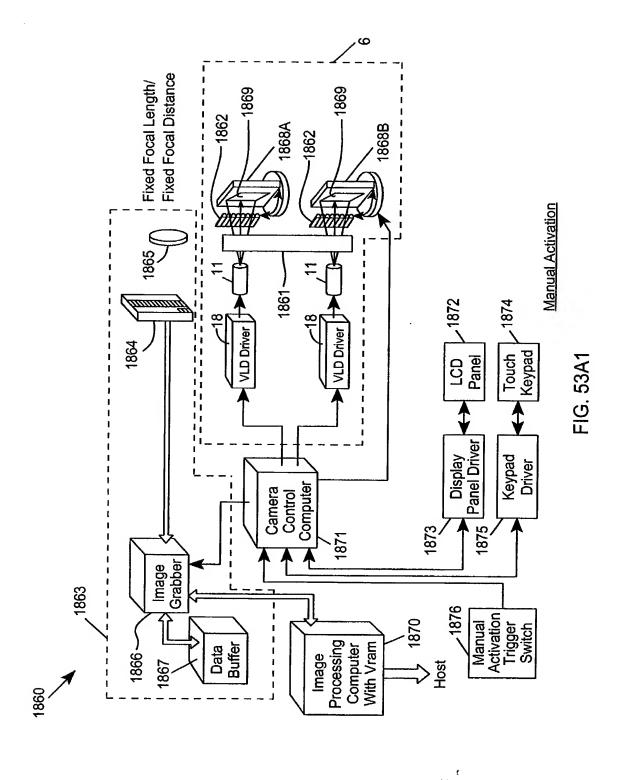




. .g. .....

FIG. 52B

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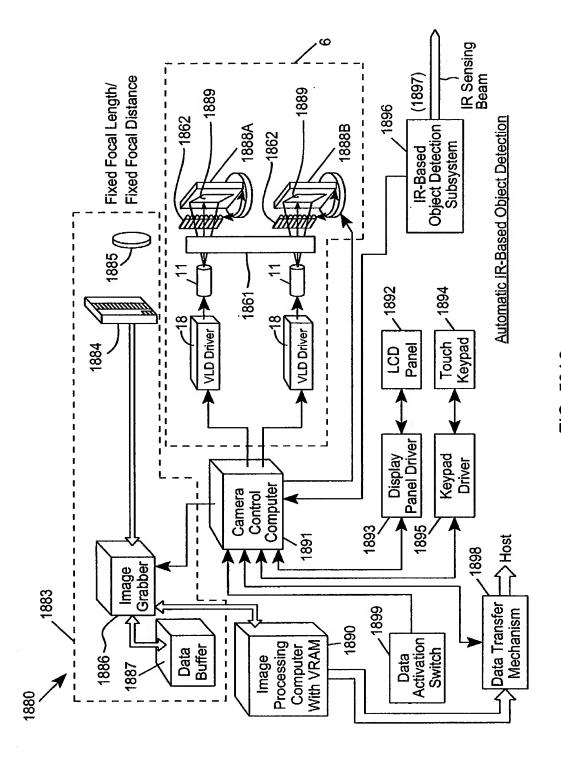


FIG. 53A2

\$."

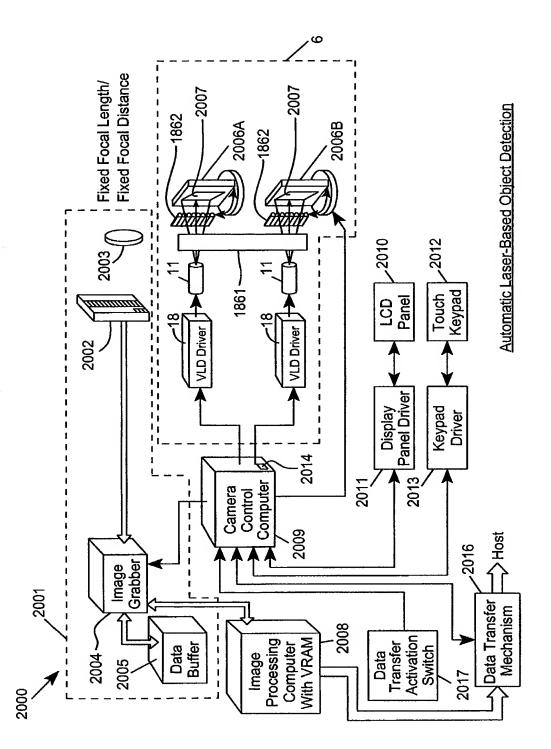


FIG. 53A3

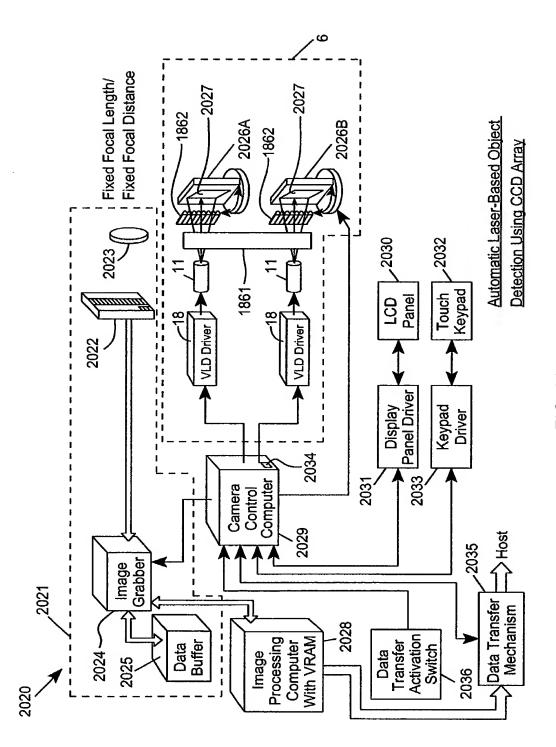


FIG. 53A4

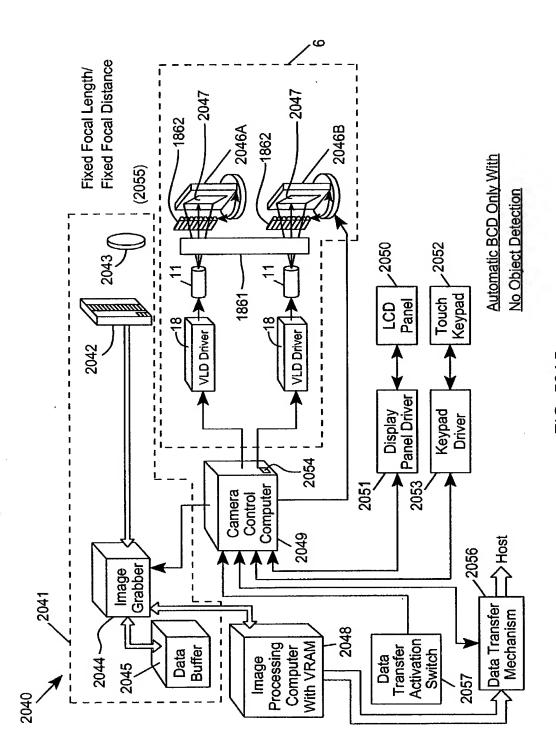


FIG. 53A5

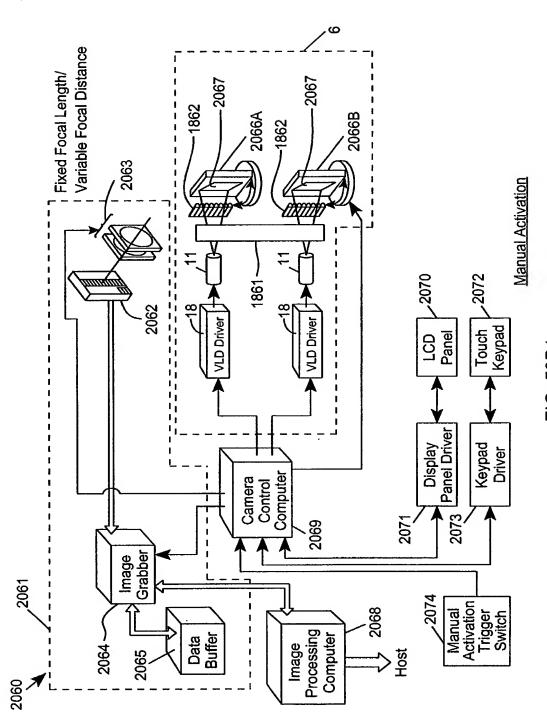
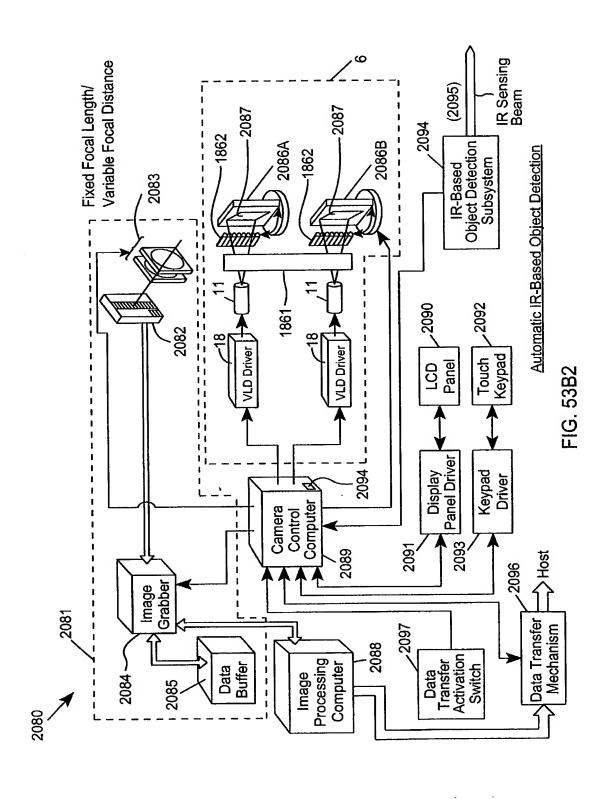
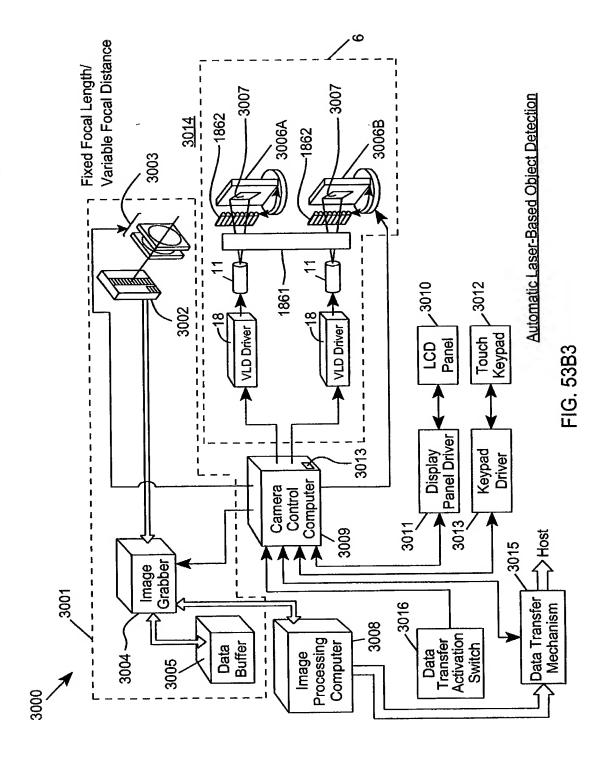


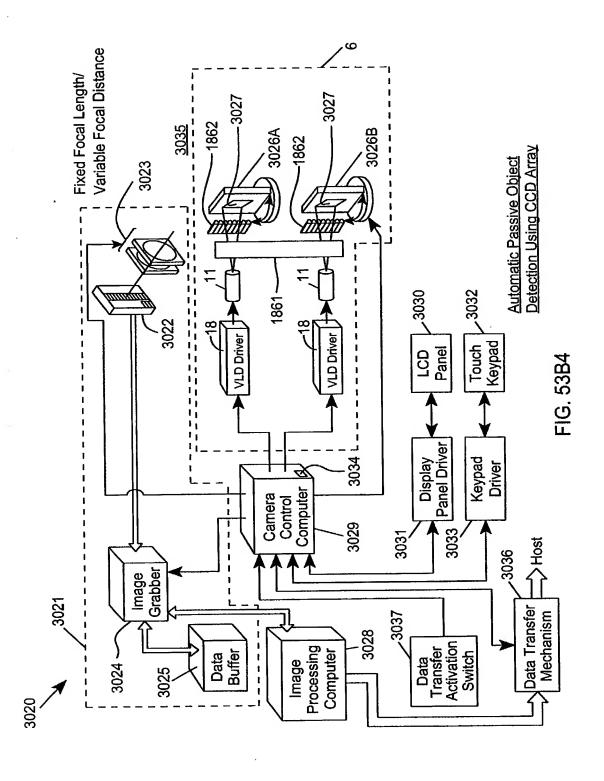
FIG. 53B1

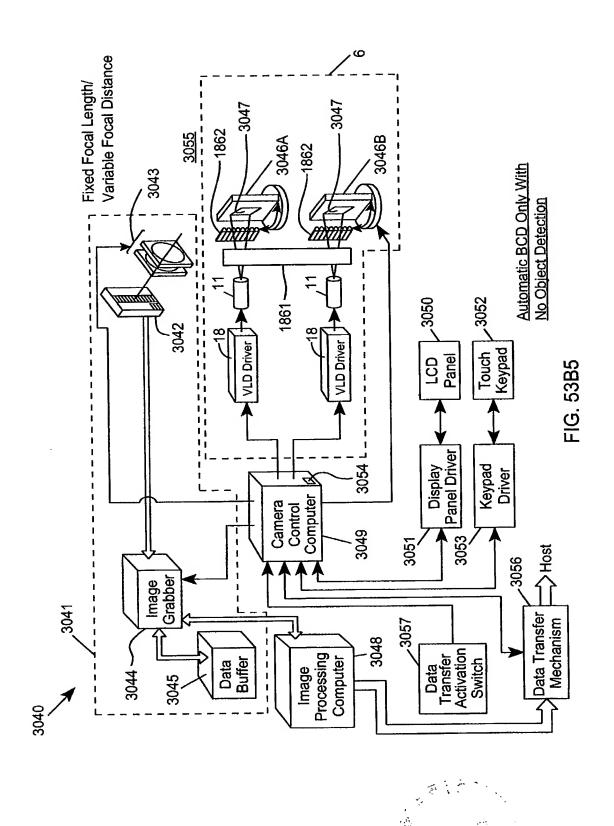


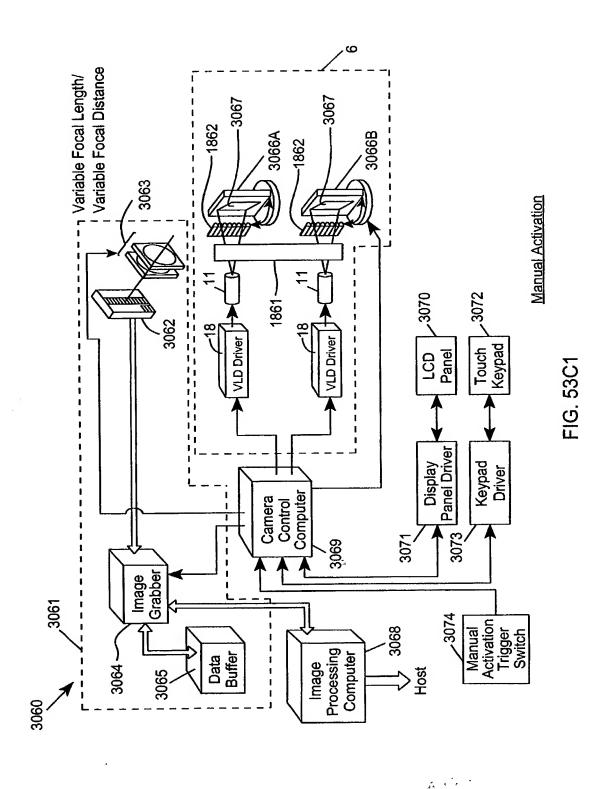
--01 011

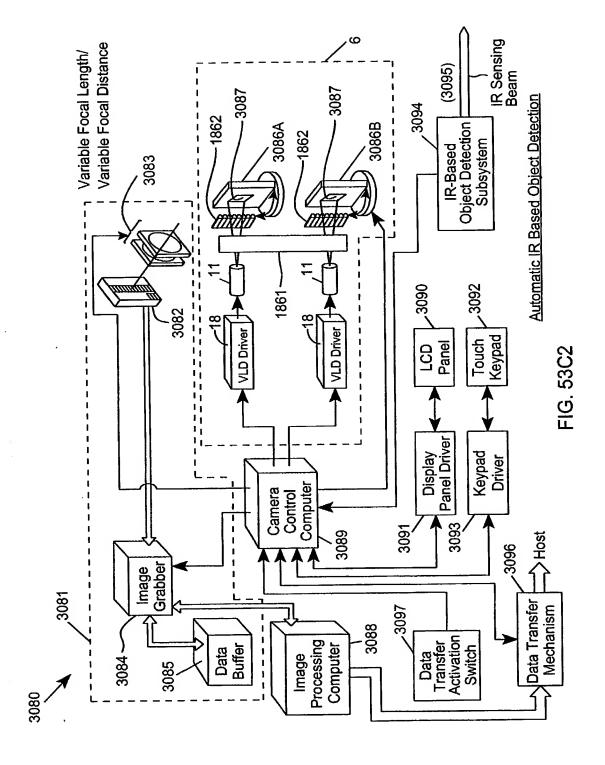


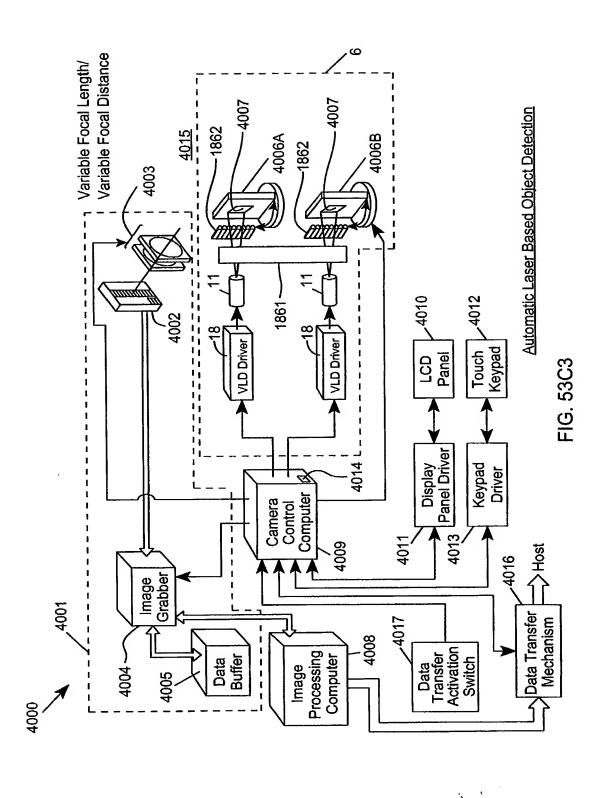


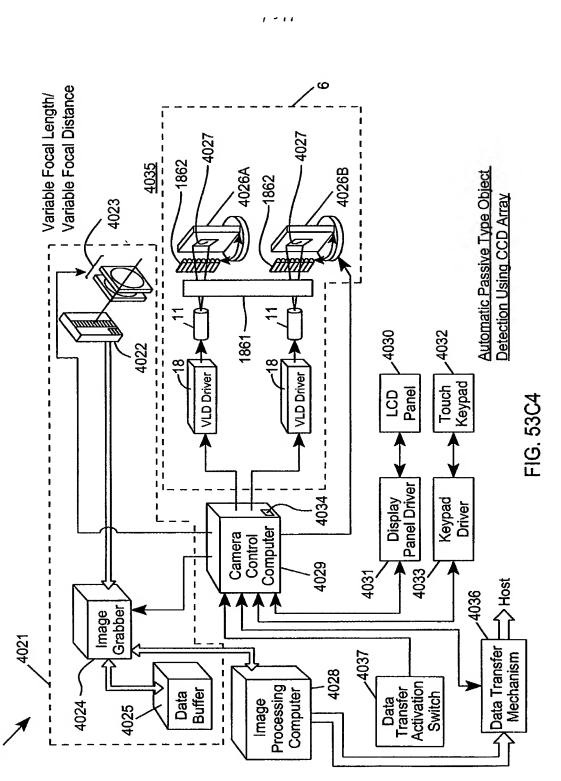


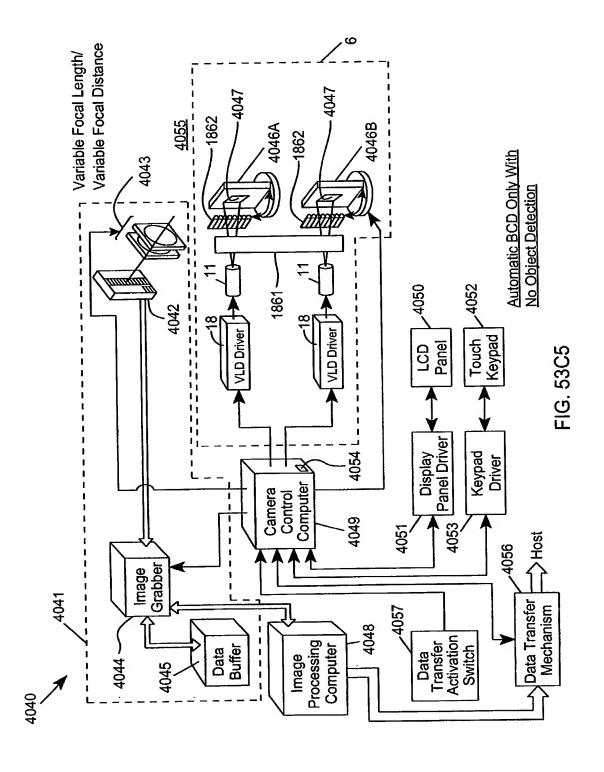


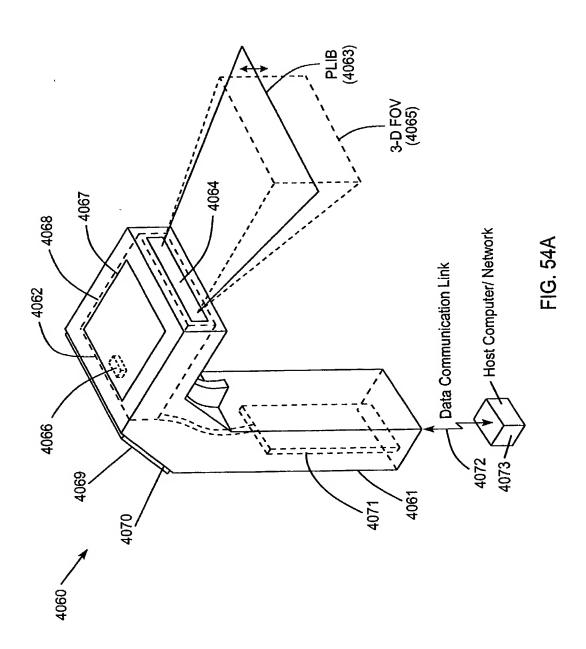












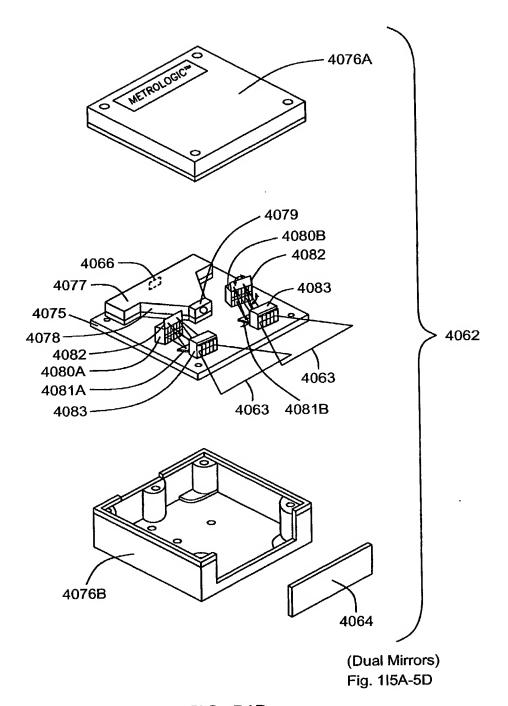
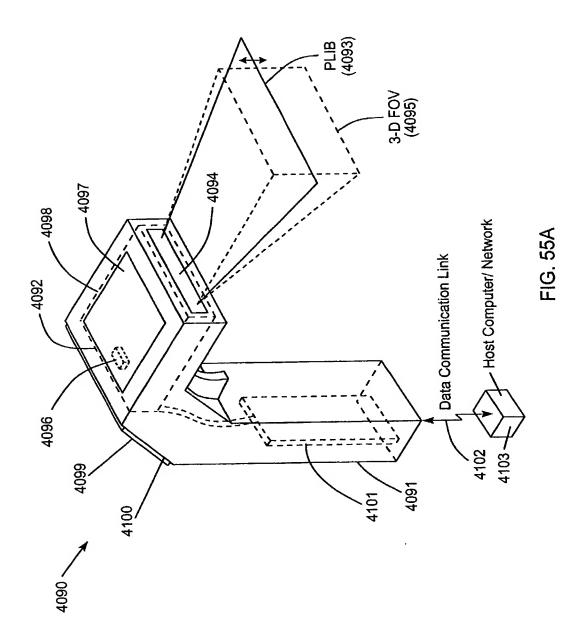


FIG. 54B



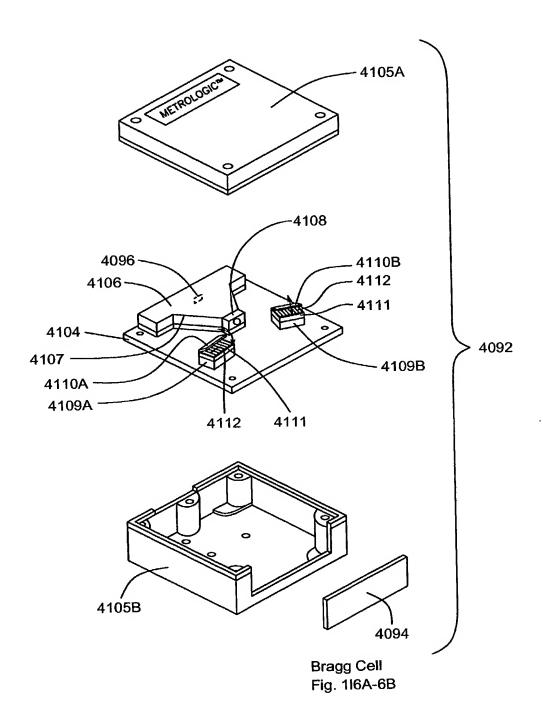
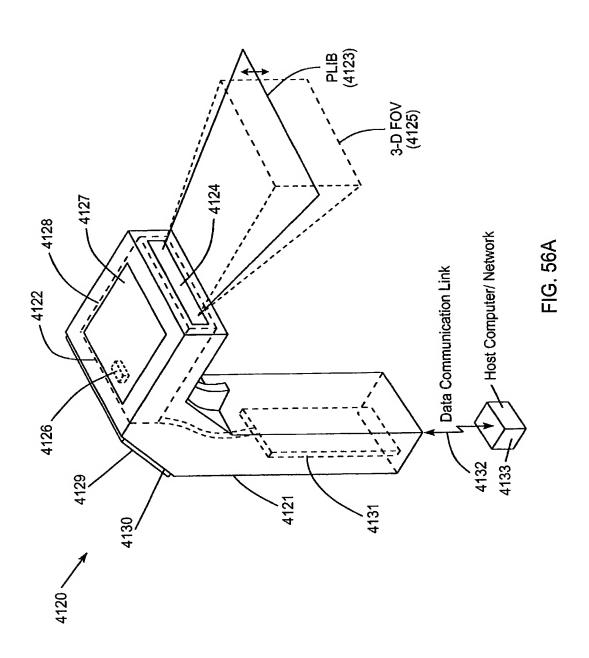


FIG. 55B



- 1 -11

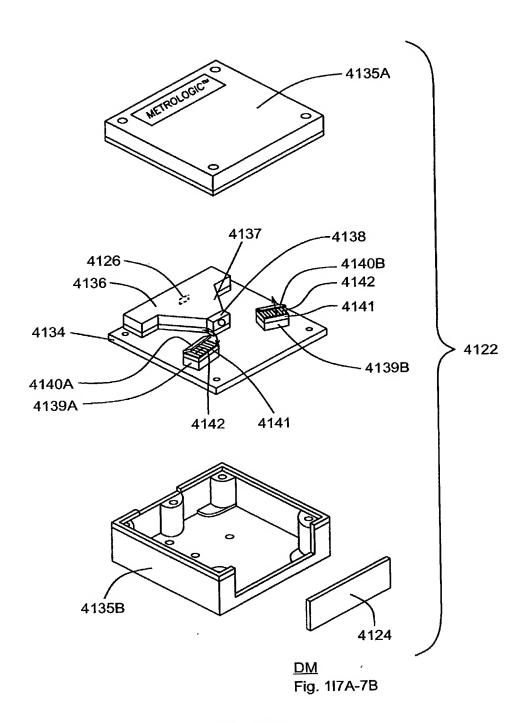
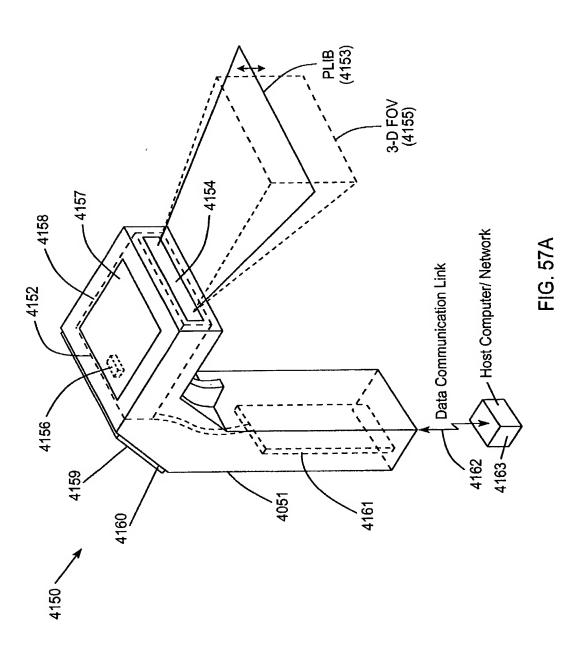


FIG. 56B





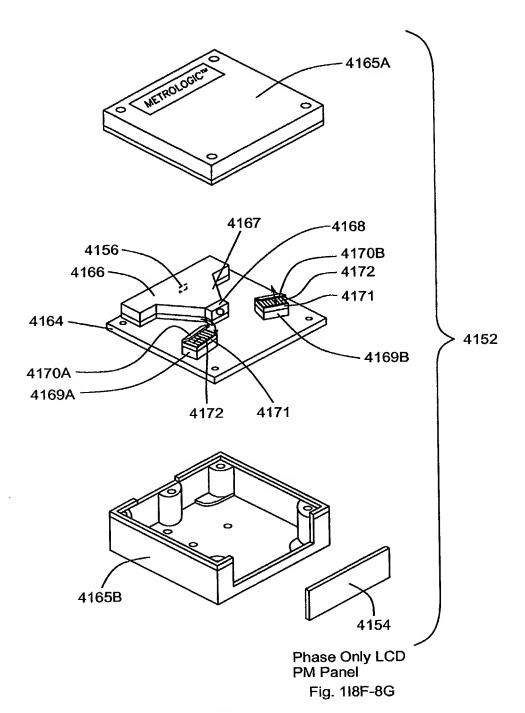
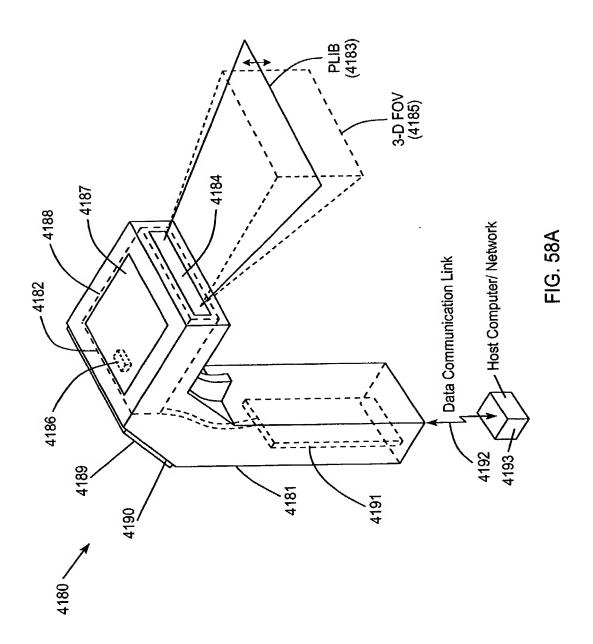
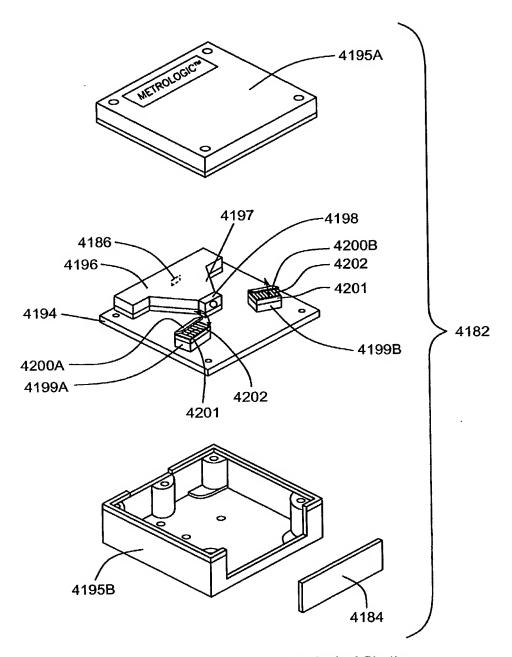


FIG. 57B





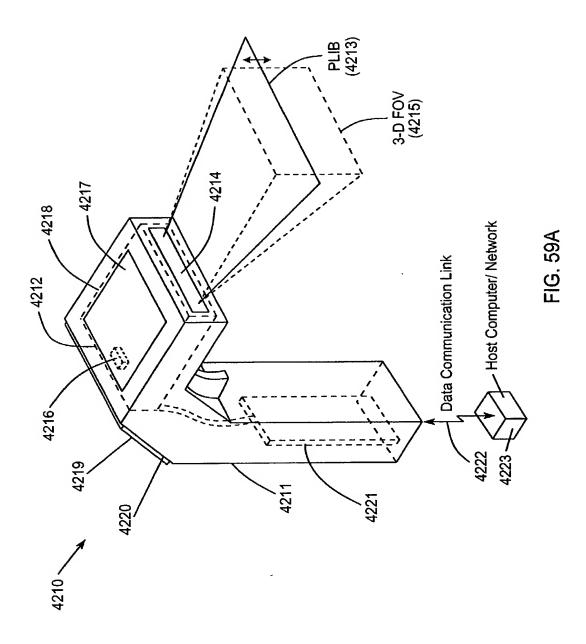
#### U21/27+



HS Optical Shutter Fig. 1114A-14B

FIG. 58B







## 200/34+

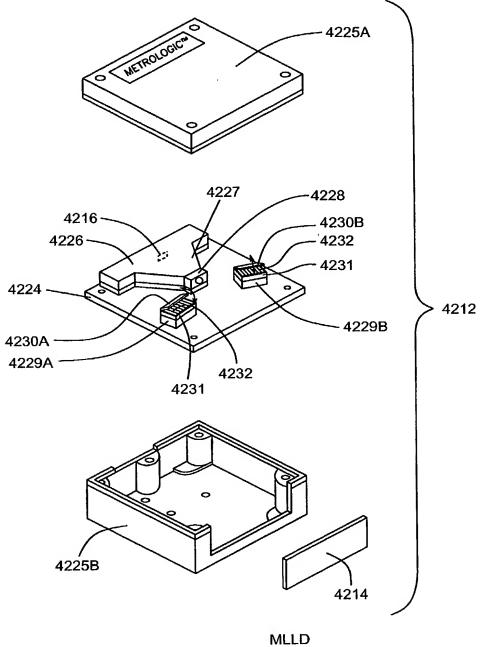
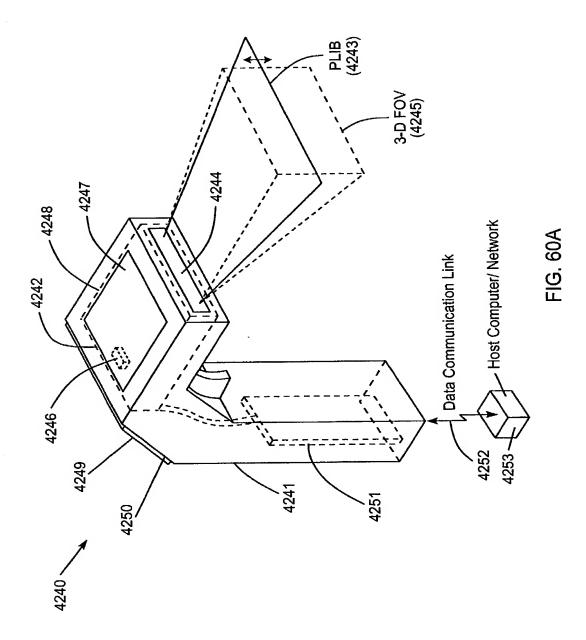
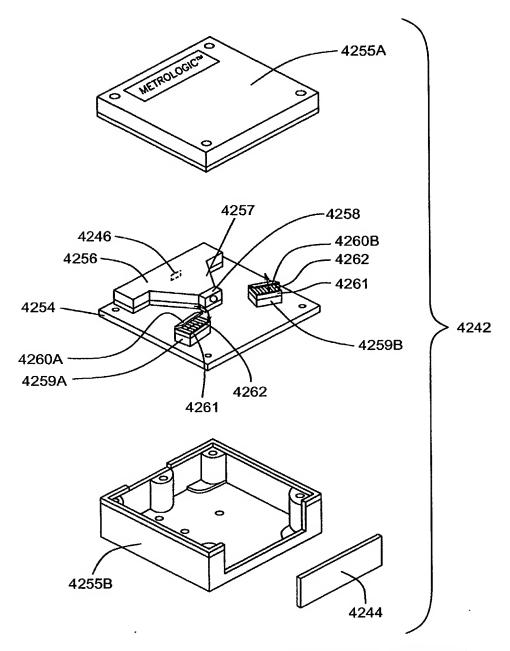


Fig. 1115A-15B

FIG. 59B



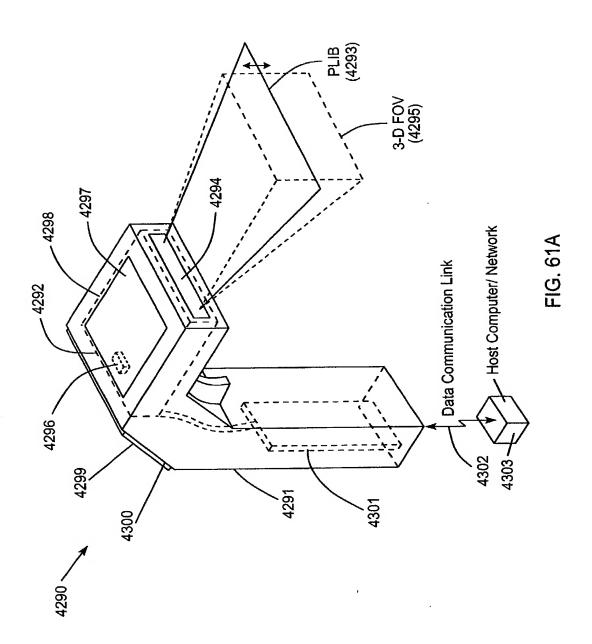


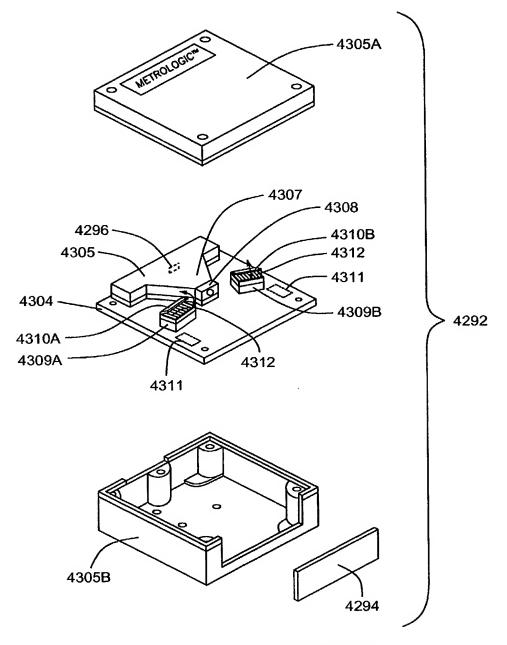


Etalon (Temp. Phase Mod.) Fig. 1I17A-17B

FIG. 60B

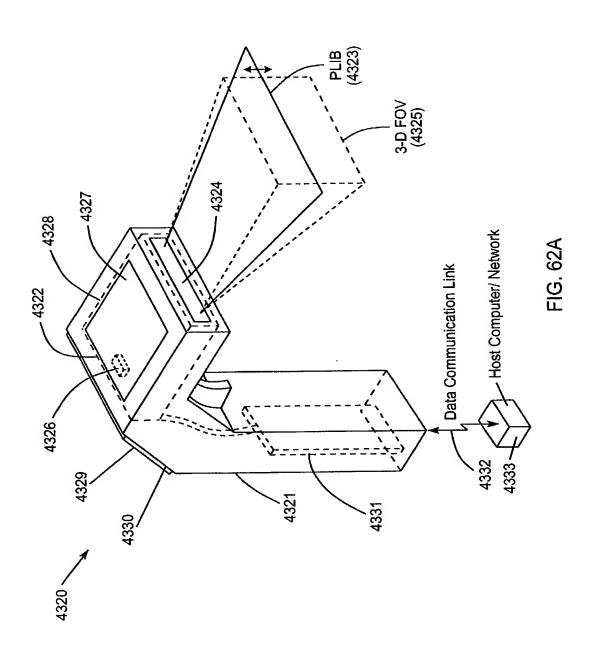


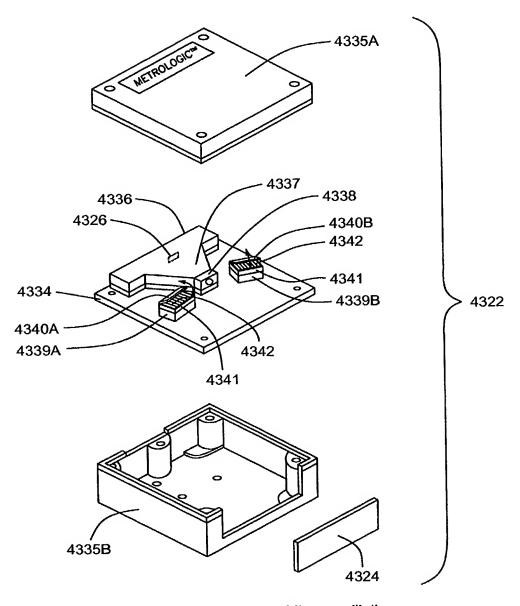




Mode Hopping Fig. 1I19A-19B

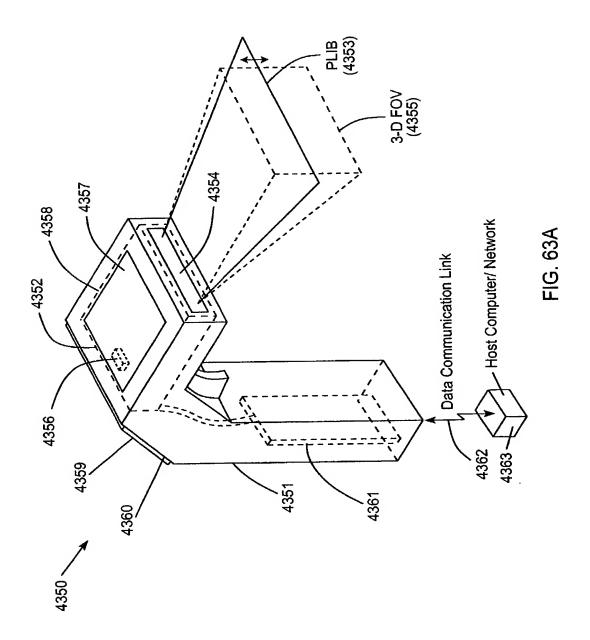
FIG. 61B

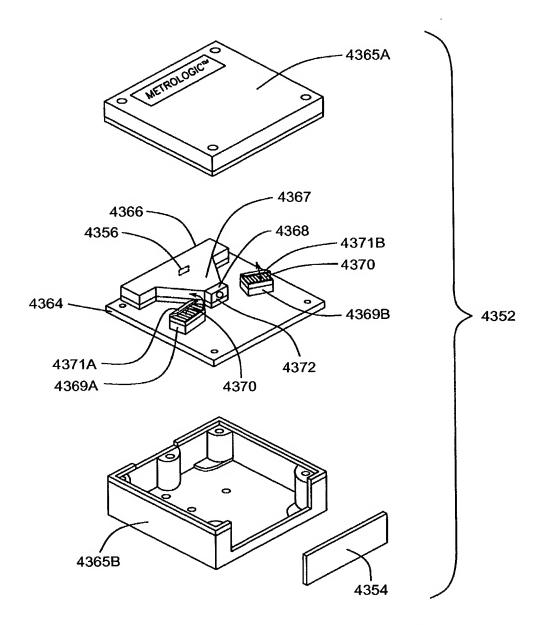




Micro-oscillating Spatial Intensity Modulation Panels Fig. 1I21A-21D

FIG. 62B

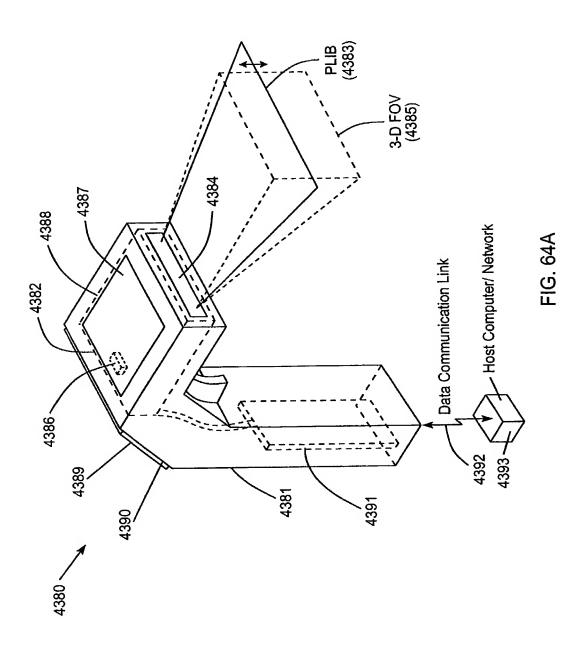




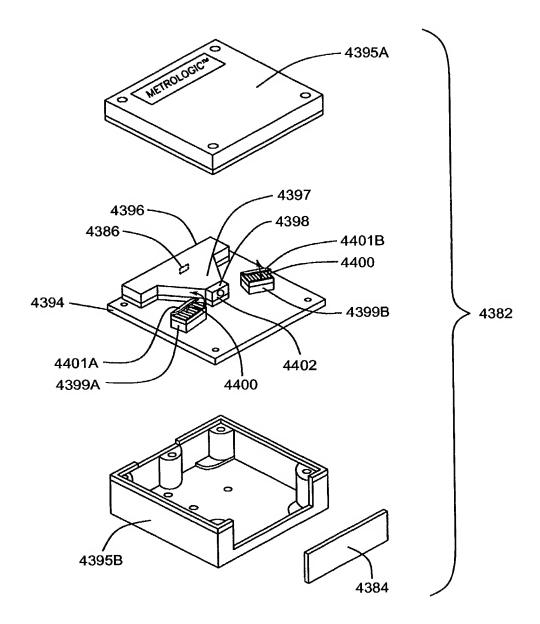
EO or Mechanically Rotating Iris Fig. 1I23A-23B

FIG. 63B

- 11-11



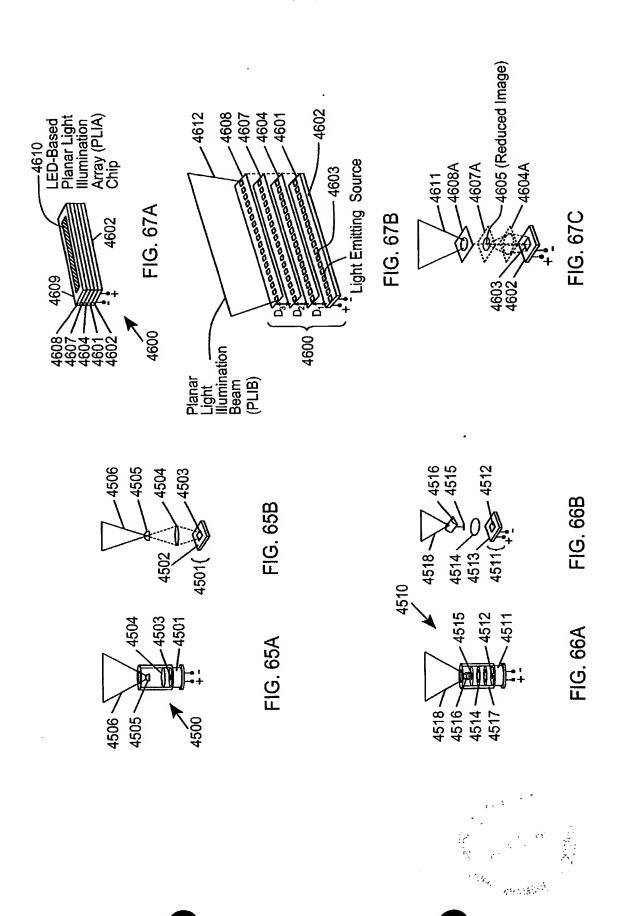




E-optical Shutter Before IFD Lens Fig. 1I24A

FIG. 64B





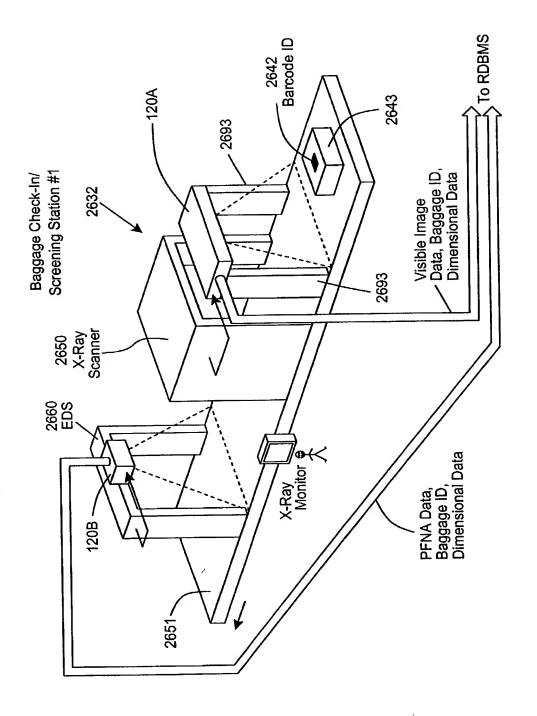
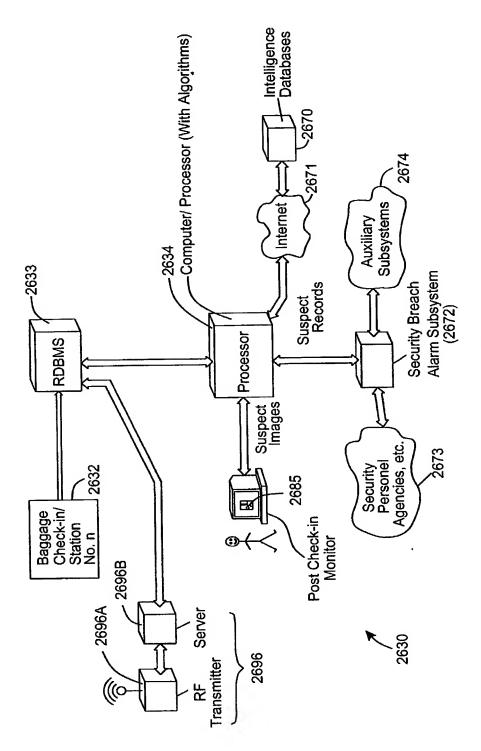


FIG. 68-1



"Airport Security System"

FIG. 68-2

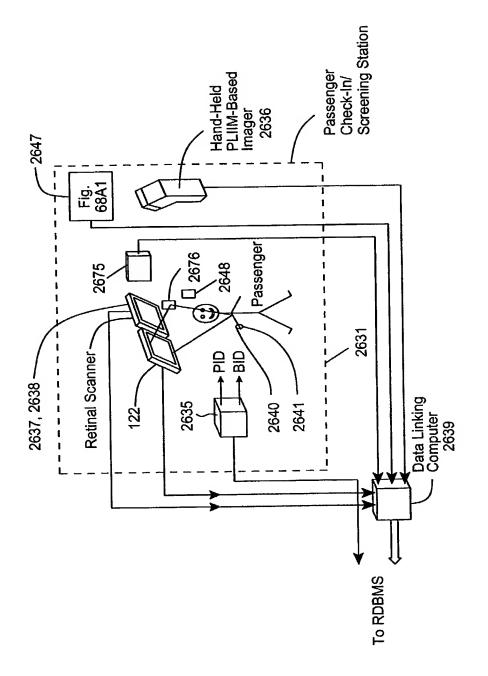
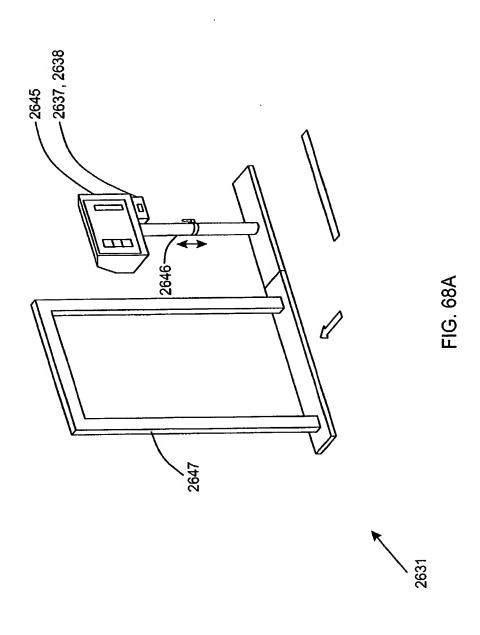
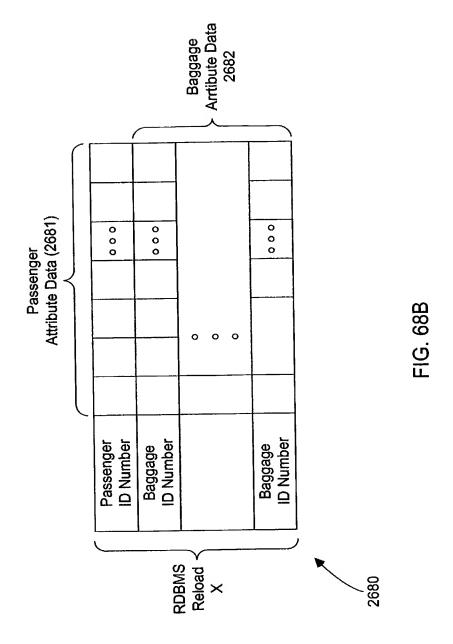


FIG. 68-3











- 1 - 1 - 17

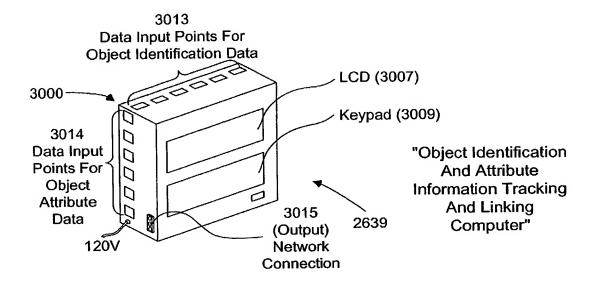


FIG. 68C1

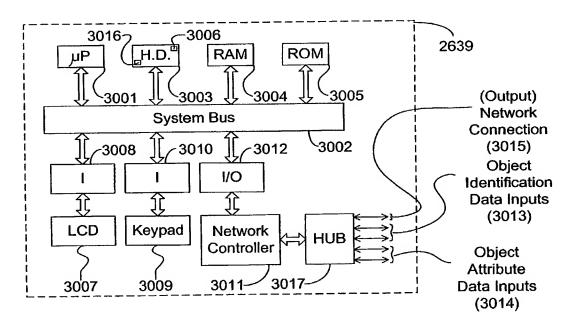
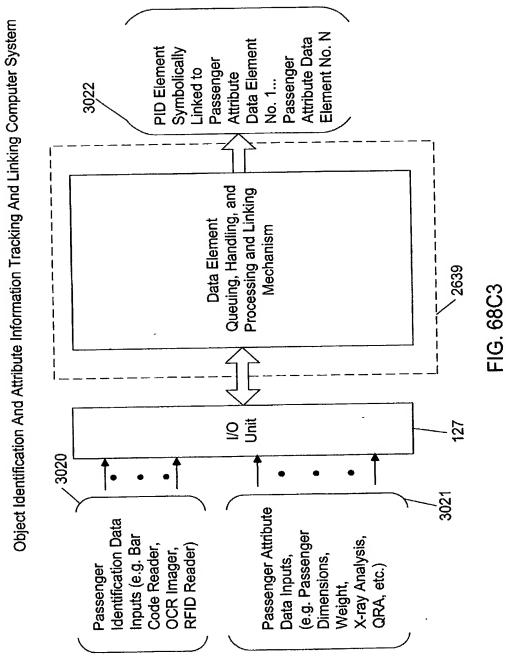
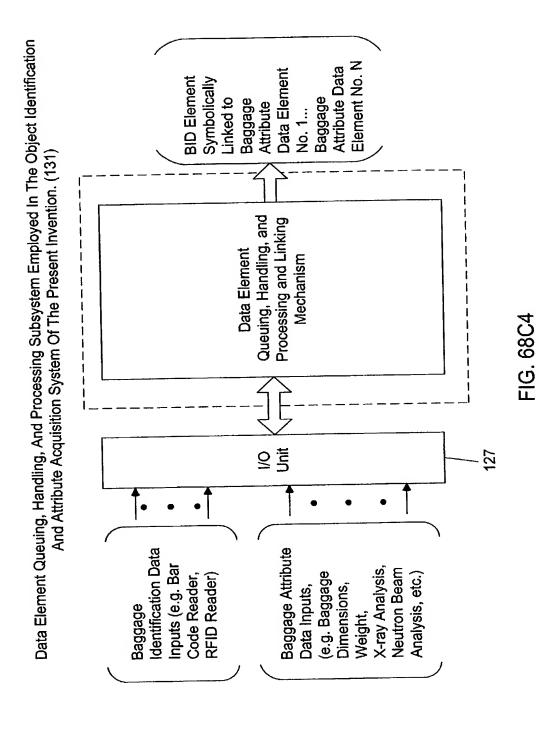


FIG. 68C2







Each passenger who is about to board an aircraft at an airport, would first go to check-in station with personal identification (e.g. passport, drivers license, national identification card, etc.) in hand, as well as with articles of baggage to be carried on board by the passenger.

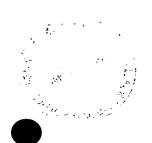
Upon checking in with this station, the Passenger Identification (PID) Bar Code Symbol And Baggage Identification (BID) Bar Code Symbol Dispensing Subsystem issues (1) a passenger identification bracelet bearing (or otherwise encoded with) a PID bar code symbol, and (2) a corresponding PID bar code symbol for attachment to each package carried on the aircraft by the passenger. At the same time, this subsystem creates, for each passenger and set of baggage checked into the system at the check-in station, a passenger/baggage information record in the Passenger and Baggage Attribute RDBMS.

The passenger identification (PID) bracelet (or identification badge) is affixed to the passenger s person at the passenger check-in station which is to be worn during the entire duration of the passenger's scheduled flight.

The PLIIM-Based Passenger Identification And Profiling Camera Subsystem at the passenger check-in automatically captures (i) a digital image of the passenger s face, head and upper body, (ii) a digital profile of his or her face and head (and possibly body) using the LDIP subsystem employed therein, and (iii) a digital image of the passenger s identification card(s). Other biometric information acquisition devices provided at the passenger check-in station can be used to aquire from each passenger checking-in, passenger attribute information (e.g. retinal pattern information, fingerprint pattern information, voice pattern information, facial pattern information, DNA pattern information) to assist in the reliable identification of the passenger.

Each item of passenger attribute information acquired at the passenger check-in station is co-indexed with the corresponding passenger identification (PID) number, and stored in the information records maintained in the Passenger and Baggage Attribute RDBMS, subsequent information processing.

FIG. 68D1



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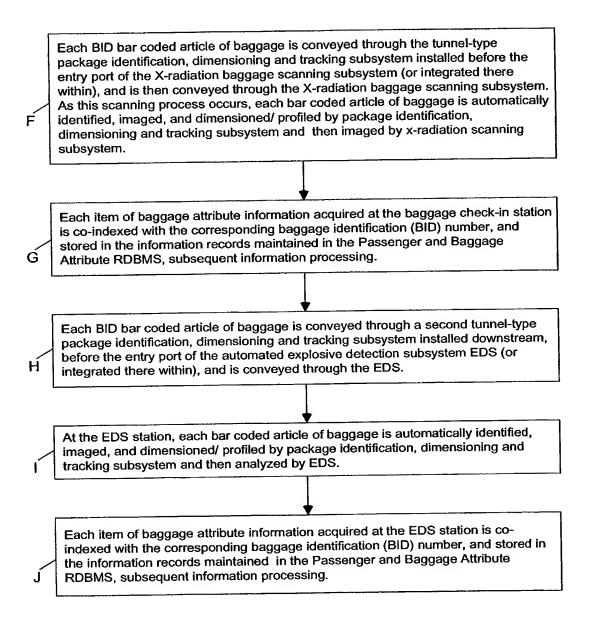


FIG. 68D2



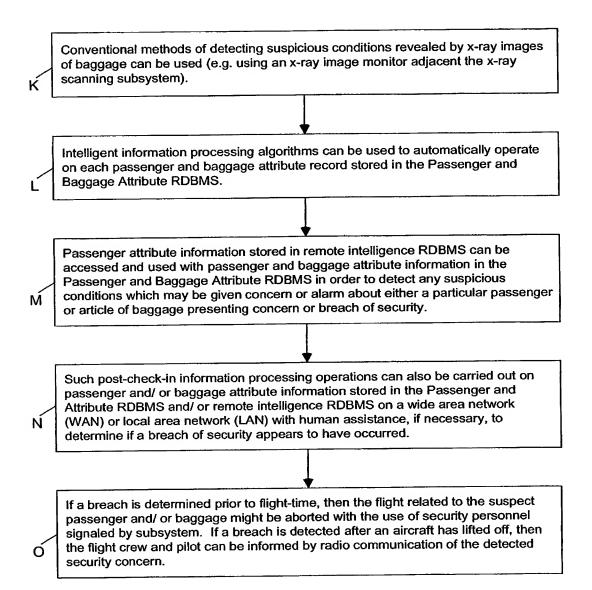


FIG. 68D3



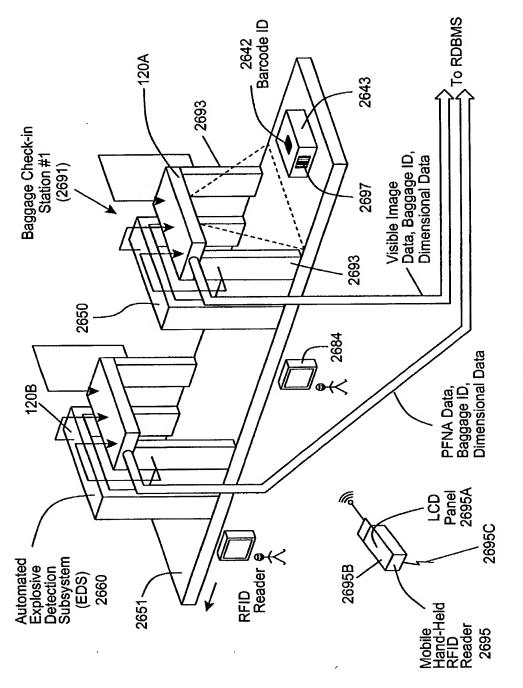


FIG. 69-1



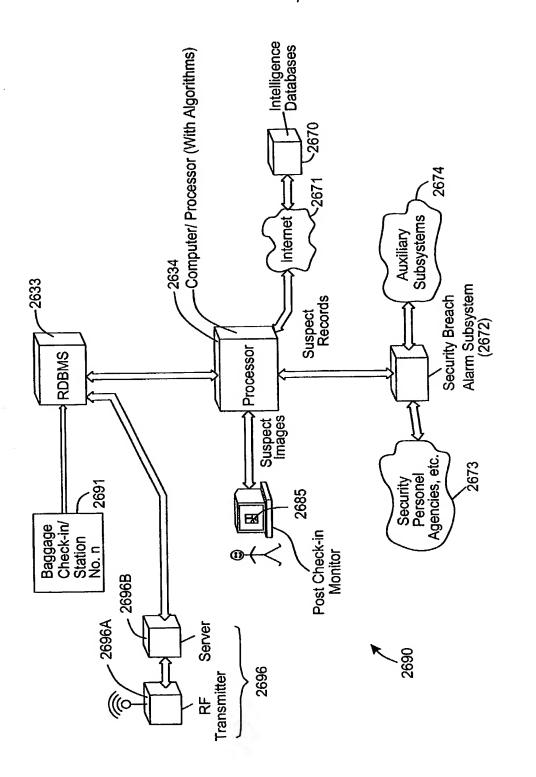


FIG. 69-2

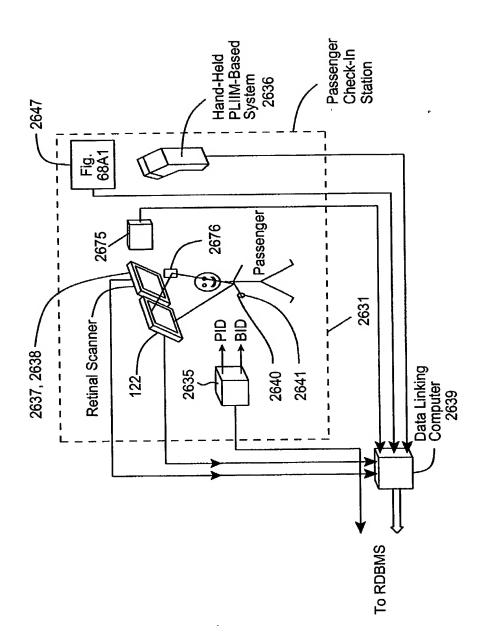
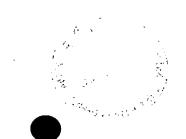


FIG. 69-3



Each passenger who is about to board an aircraft at an airport, would first go to check-in station with personal identification (e.g. passport, drivers license, national identification card, etc.) in hand, as well as with articles of baggage to be carried on board by the passenger.

Upon checking in with this station, the Passenger Identification (PID) Bar Code Symbol And Baggage Identification (BID) Bar Code Symbol Dispensing Subsystem issues (1) a passenger identification bracelet bearing (or otherwise encoded with) a PID bar code symbol, and (2) a corresponding PID bar code symbol for attachment to each package carried on the aircraft by the passenger. At the same time, this subsystem creates, for each passenger and set of baggage checked into the system at the check-in station, a passenger/baggage information record in the Passenger and Baggage Attribute RDBMS.

B

The passenger identification (PID) bracelet (or identification badge) is affixed to the passenger s person at the passenger check-in station which is to be worn during the entire duration of the passenger's scheduled flight.

The PLIIM-Based Passenger Identification And Profiling Camera Subsystem at the passenger check-in automatically captures (i) a digital image of the passenger s face, head and upper body, (ii) a digital profile of his or her face and head (and possibly body) using the LDIP subsystem employed therein, and (iii) a digital image of the passenger s identification card(s). Other biometric information acquisition devices provided at the passenger check-in station can be used to aquire from each passenger checking-in, passenger attribute information (e.g. retinal pattern information, fingerprint pattern information, voice pattern information, facial pattern information, DNA pattern information) to assist in the reliable identification of the passenger.

Each item of passenger attribute information acquired at the passenger check-in station is co-indexed with the corresponding passenger identification (PID) number, and stored in the information records maintained in the Passenger and Baggage Attribute RDBMS, subsequent information processing.

FIG. 69B1

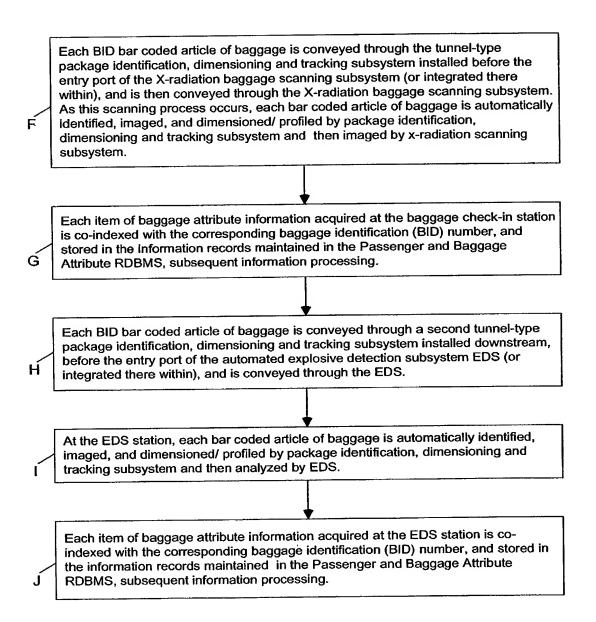


FIG. 69B2



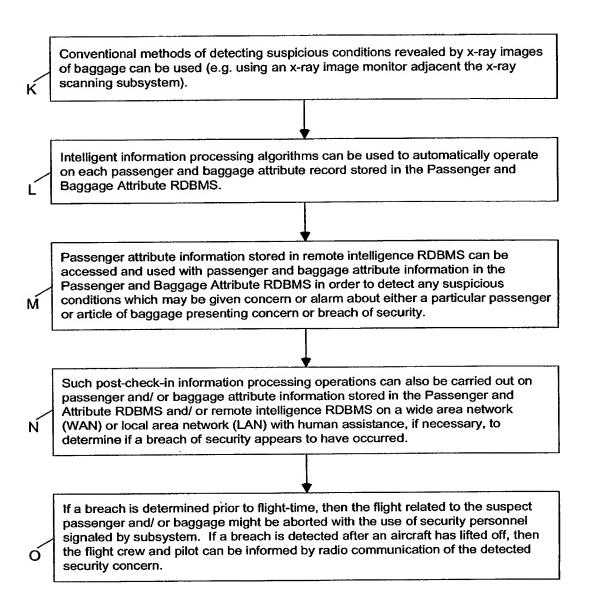


FIG. 69B3



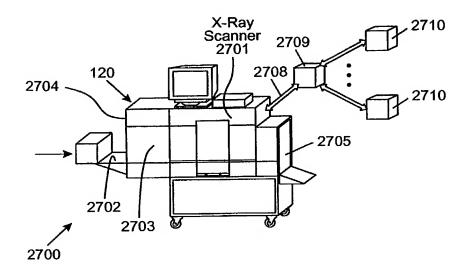


FIG. 70A

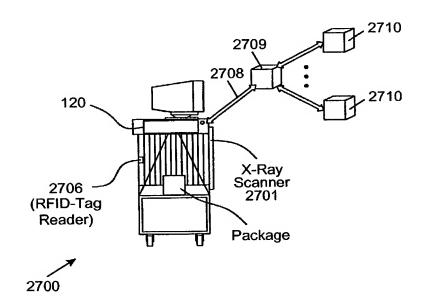


FIG. 70B

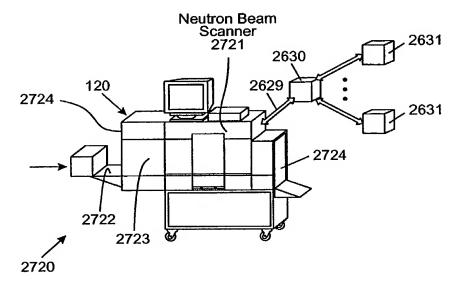


FIG. 71A

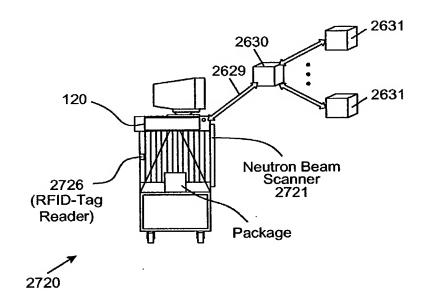


FIG. 71B



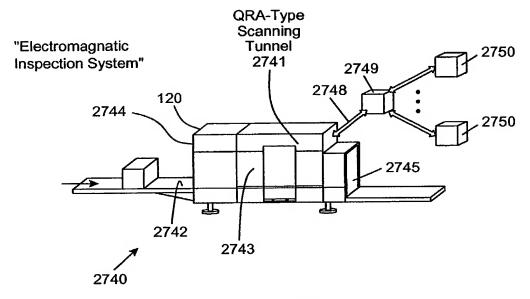


FIG. 72A

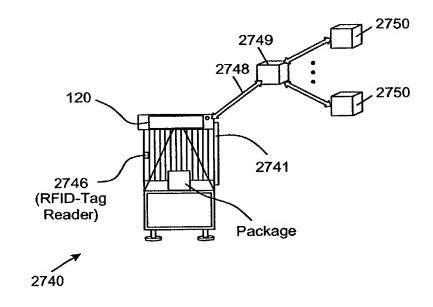


FIG. 72B



# 30t/397

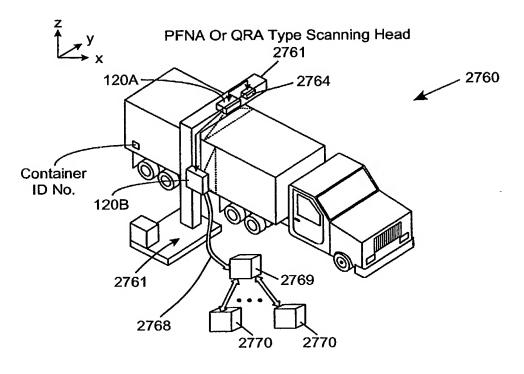
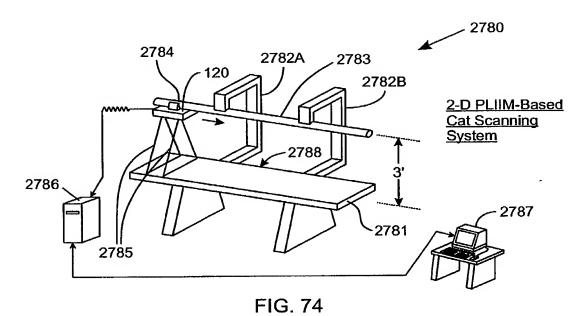
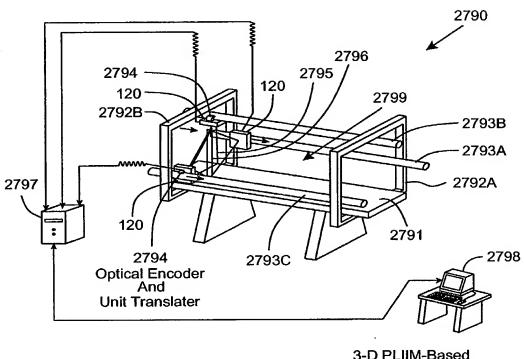


FIG. 73



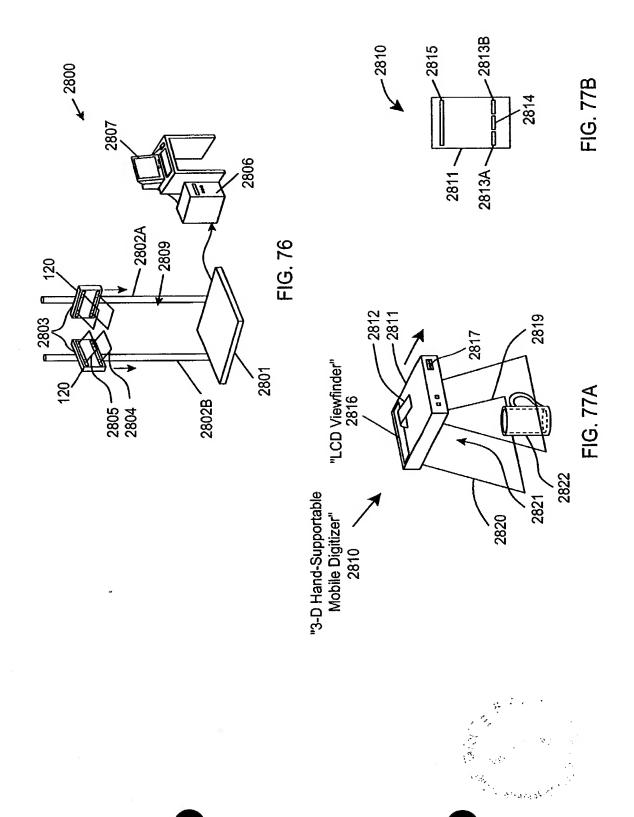




3-D PLIIM-Based Cat Medical Scanning System

FIG. 75





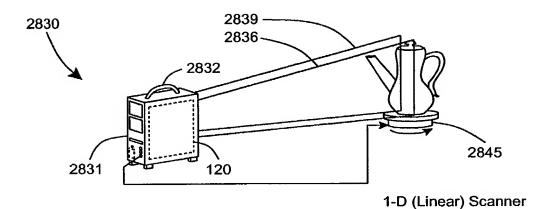


FIG. 78A

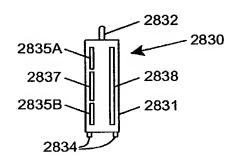


FIG. 78B

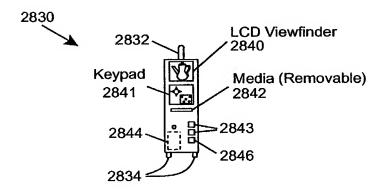


FIG. 78C



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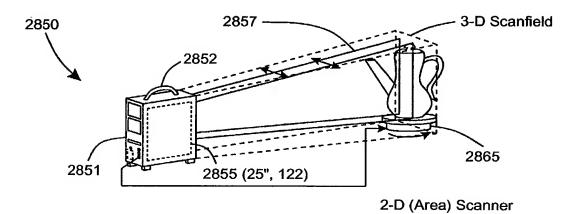


FIG. 79A

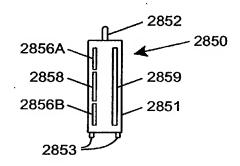


FIG. 79B

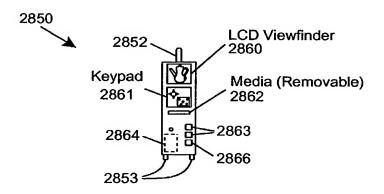
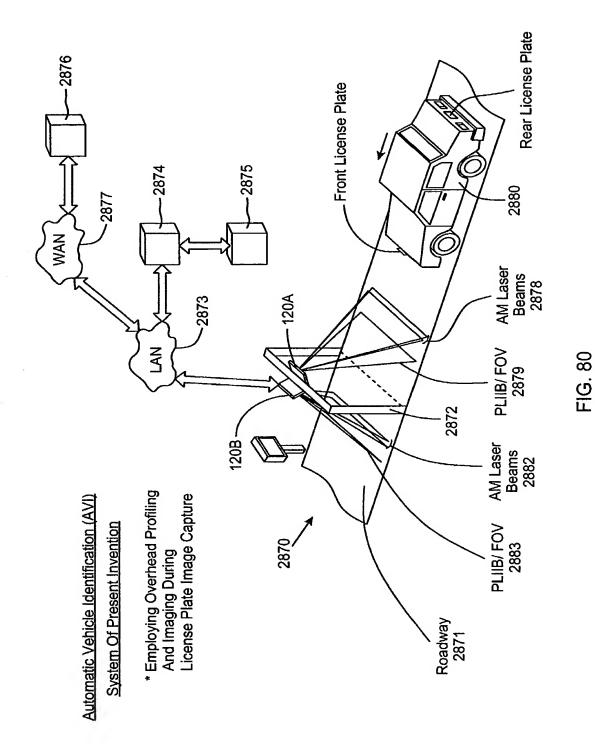


FIG. 79C



-2898 Automatic PLIB/ FOV Direction Switching Unit (2891) -2896 2897 ~2899 2894 WAN Optical Path 2 2895 Optical Path 1 Š 2893 120-AM Laser Beams (2910) Traffic Direction \* Employing Overhead Profiling And Imaging Techniques During License Plate Image Capture Automatic Vehicle Identification (AVI) System Of Present Invention Roadway (2892)

FIG. 81A

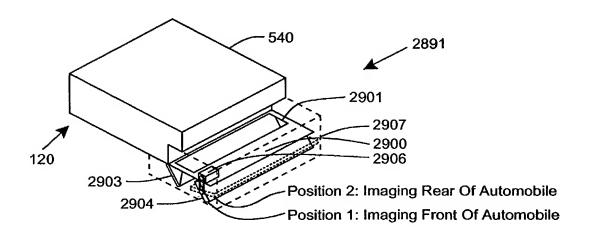


FIG. 81B 2901 **Automatic PLIB/ FOV** 2906 **Direction Switching Unit** 120 2900 2891 2904 2903 **AM Laser** - 2907 Beams (2910)2908 2894 Optical Path 2

FIG. 81C

Optical Path 1

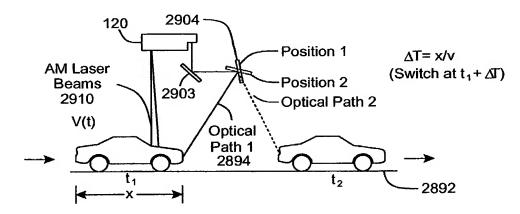
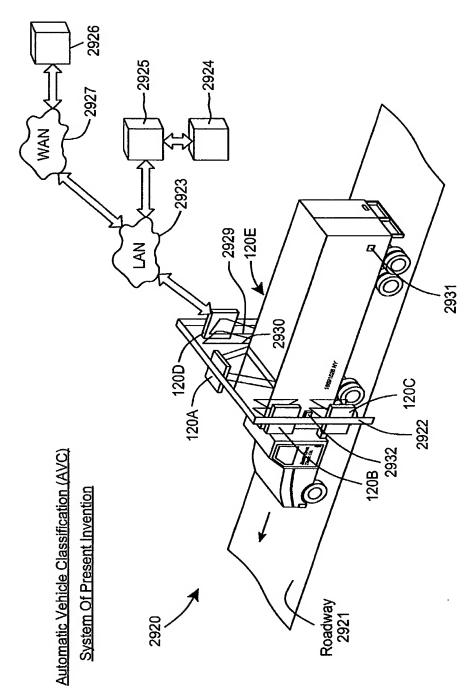


FIG. 81D





\* Employing Overhead And Lateral Profiling And Imaging Techniques

FIG. 82



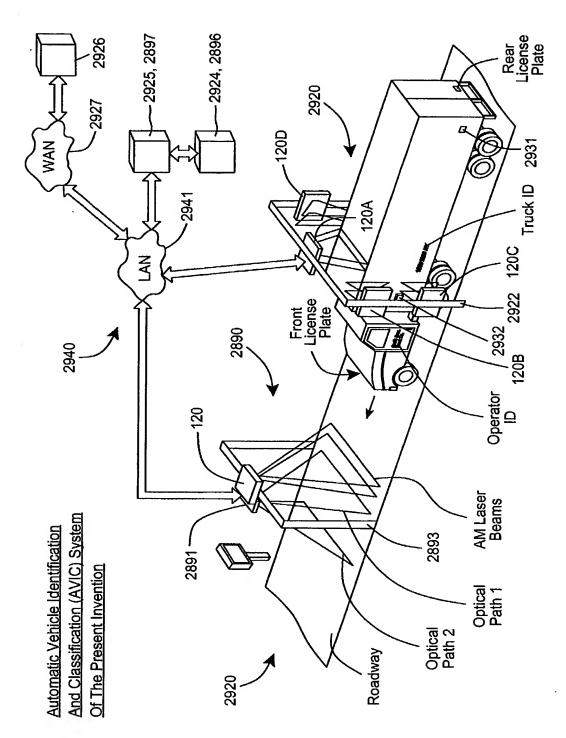


FIG. 83

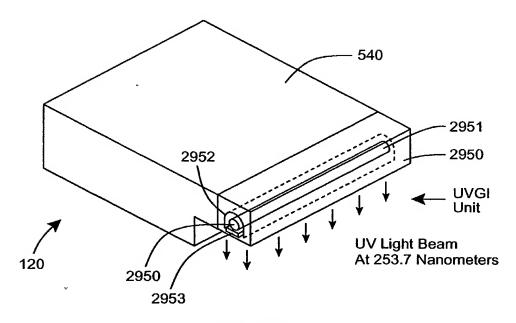


FIG. 84A

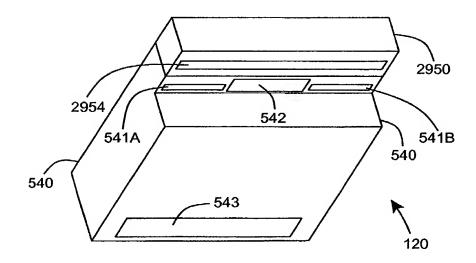


FIG. 84B